

MARKED-UP VERSION OF SUBSTITUTE SPECIFICATION

SPECTACLE AND CONTACT LENS SELECTING SYSTEM AND METHOD THEREOF

BACKGROUND OF THE INVENTION

5 1. Field of the Invention

The present invention relates to a spectacle and contact lens selecting system and a method thereof, and in particular, to a spectacle and contact lens selecting system and a method thereof, which enable the selection of spectacles and contact
10 lenses fitted to each person on a computer network.

2. Description of the Related Art

Conventionally known ~~as means~~ methods for selecting spectacles lenses are methods which utilize eyeball models. ~~As~~
15 ~~the~~ Well known eyeball models, ~~well known~~ are the Gullstrand eyeball model and the Le-Grand eyeball model.

These eyeball models have been used entirely for the design and evaluation of spectacles lenses. For the design of spectacles lenses, one standard model prepared as an optical
20 eye model would make it possible to design lenses having various powers for standard eyes. This is sufficiently ~~enough~~ for the design irrespective of the eye structure of a person because he/she can select among spectacles lenses prepared in every power of 0.25D by actually wearing them, thereby
25 ensuring that he/she finds spectacles lenses suitable for

correction. That is, ~~there~~selection is a ~~flexibility of~~
~~selection~~flexible.

~~These days~~ Currently, on the other hand, to measure
uncorrected or corrected vision, one goes to see an
5 ophthalmologist or has his/her vision measured at spectacles
shops using ~~their~~ optometers.

Recently, for example, virtual malls are available over
networks such as the Internet, ~~however, any~~. However, none of
the spectacles shops available in these virtual malls provides
10 ~~ne a~~ system for measuring the uncorrected and corrected vision
on an on-line basis.

However, to solely determine the power of spectacles
lenses suitable for the eyes of an individual, an optical
model such as the eyeball model assumed to be commonly
15 applicable to everyone would cause significant error in
optical calculation thereby making the determination
impossible. The determination can be made only by constructing
an eyeball model for each person.

~~Using~~Use of the conventional eyeball models, ~~as they are,~~
20 will ~~raise~~create the following problems. ~~That is,~~

· Since the conventional eyeball model is based on measurements
made on eyes of people from Europe and the United States, they
cannot be used for constructing a model having values close to
those obtained by measuring living eyes of other races, e.g.,
25 Japanese people. For example, Japanese have a smaller radius

of curvature of the cornea than do people from Europe and the United States.

· A model is prepared based on an average of measurements.

~~Literatures show~~ Literature shows that in such data that,
5 the depth of the anterior chamber of the eye varies with age
or the length of the eye axis is correlated with the degree of
myopia for low degrees of shortsightedness. Thus, it is
~~apparently necessary~~ to construct an eyeball model according
to the age and the degree of myopia of each individual.

10 · Although the lens of the eye has a refractive index that is
unevenly distributed, the average refractive index is used.
The simplified double structure provided to the lens of the
eye causes a significant error in tracking rays of light.

On the other hand, where difficulty is found in visiting
15 medical care providers or spectacles shops such as due to the
time required and the distance traveled for the visit, there
has been a need for implementing a system which enables one to
remotely measure his/her vision over the Internet.

In particular, ~~one's currently wearing a~~ person's current
20 spectacles or contact lenses may provide more blurred viewing
~~than before, no longer properly correct their vision.~~ In this
case, it would be very convenient ~~if one can to~~ remotely
measure his/her uncorrected and corrected vision in order to
determine whether he/she needs to buy new spectacles or
25 contact lenses.

Moreover, if a user can see himself/herself wearing spectacles or contact lenses ~~at the selection of~~ when selecting spectacles or contact lenses, the selection of spectacles or contact lenses ~~can be further ensured with increased~~ facilitation.

~~It is therefore a principal object of the present invention to provide a system and method for determining an spectacles/contact lens power suitable for an individual, and for confirming wearing condition.~~ facilitated.

SUMMARY OF THE INVENTION

~~A spectacle and contact lens selecting system set forth in claim 1 of the present invention, comprises: input means for inputting information related to~~ To overcome the problems described above, preferred embodiments of the present invention provide a system and method for determining a spectacles/contact lens power suitable for an individual, and for confirming wearing condition.

A spectacle and contact lens selecting system according to a ~~state~~ preferred embodiment of the present invention includes an input unit for inputting information related to the condition of the eyes of a user, ~~an eyeball optical model deciding means~~ unit for deciding an eyeball optical model corresponding to the information related to the ~~state~~ condition of the eyes input by the input ~~means~~ unit, an eyeball

accommodation range determination ~~means~~unit for examining
optical performance of an eyeball within a range of
accommodation of the user in the eyeball optical model decided
by the eyeball optical model deciding ~~means~~unit to determine
5 the range of accommodation of the eyeball~~_, a~~ lens power
selecting ~~means~~unit for examining optical performance when the
user wears spectacles or contact lenses to select a lens
power~~_, and a~~ wearing state display ~~means~~unit for generating
and displaying a wearing state of the spectacles or the
10 contact lenses to be selected.

~~The~~In the spectacle and contact lens selecting system-
~~set forth in claim 2 of the present invention, the input unit~~
is ~~recited in claim 1, wherein the input means is~~ preferably
configured so as to allow the user to input information
15 ~~ef~~about the eyes of the user, such as a wearing condition of
the user, an age, a near point distance, a far point distance,
or a vision at a constant distance.

~~The~~In the spectacle and contact lens selecting system-
~~set forth in claim 3 of the present invention is recited in~~
20 ~~claim 1 or 2, wherein,~~ the eyeball optical model deciding
~~means comprises~~ unit preferably includes a start eyeball
optical model deciding ~~means~~unit for deciding a start eyeball
optical model based on the information ~~ef~~about the eyes of the
user, such as an age and an approximated lens power.

25 ~~The~~In the spectacle and contact lens selecting system

~~set forth in claim 4 of the present invention is recited in~~
~~any one of claims 1 to 3, wherein,~~ the eyeball optical model
deciding means ~~is~~ is preferably configured ~~so~~ such that at
least one of a focal state in the eyeball of the user at an
5 accommodation midpoint calculated from a near point distance
and a far point distance of the user ~~becomes optimal and/or~~ a
focal state in the eyeball of the user in a non-accommodative
state calculated from the far point distance of the user
~~becomes optimal~~ is optimized.

10 The spectacle and contact lens selecting system ~~set forth~~
~~in claim 5 of the present invention is recited in any one of~~
~~claims 1 to 4,~~ preferably further comprising includes an
eyeball optical model validity examination means unit for
examining the validity of the eyeball optical model at a limit
15 of accommodation on at least one of a near point side and/or
~~on~~ a far point side.

~~The~~ In the spectacle and contact lens selecting system-
~~set forth in claim 6 of the present invention is recited in~~
~~any one of claims 1 to 5, wherein,~~ the eyeball accommodation
20 range determination means ~~is~~ unit is preferably configured to
~~be able to determine~~ a range of accommodation of optical
dimensions of the eyeball at an accommodation midpoint.

The spectacle and contact lens selecting system ~~set forth~~
~~in claim 7 of the present invention is recited in any one of~~
25 ~~claims 1 to 6,~~ preferably further comprising includes an eyeball

optical model image generating ~~means~~unit for generating and displaying an image of an eyeball optical model in which the range of accommodation of the eyeball is determined.

The spectacle and contact lens selecting system ~~set forth~~
5 ~~in claim 8 of the present invention is recited in any one of~~
~~claims 1 to 7,~~preferably further comprising includes an
eyeball optical model focal performance examination ~~means~~unit
for examining focal performance of the eyeball optical model
at a near point or a position within a range of accommodation
10 ability in the vicinity of the near point, at a far point or a
position within the range of accommodation ability in the
vicinity of the far point, or at a position away from the near
point and the far point in a naked eye state of the user.

~~The~~In the spectacle and contact lens selecting system-
15 ~~set forth in claim 9 of the present invention is recited in~~
~~claim 8, wherein,~~ the eyeball optical model focal performance
examination ~~means comprises means~~unit preferably includes a
unit for examining a focal state of the eyeball optical model
of the user at the near point or the position within the range
20 of accommodation ability in the vicinity of the near point, at
the far point or the position within the range of
accommodation ability in the vicinity of the far point, or the
position away from the near point and the far point after
vision correction with the spectacles or the contact lenses.

25 The spectacle and contact lens selecting system ~~set forth~~

~~in claim 10 of the present invention is recited in any one of~~
~~claims 1 to 9, preferably further comprising~~ includes a
sharpness score generating ~~means~~unit for generating a
visibility sharpness score of visibility of the user at at
5 least one of before and/or after vision correction with the
spectacles or the contact lenses.

The spectacle and contact lens selecting system ~~set forth~~
~~in claim 11 of the present invention is recited in any one of~~
~~claims 1 to 10, preferably further comprising~~ includes a viewed
10 image generating ~~means~~unit for generating an image to be
viewed by the user at at least one of before and/or after
vision correction with the spectacles or the contact lenses.

~~The spectacle and contact lens selecting system set forth~~
~~in claim 12 of~~In the present invention is recited in any one
15 ~~of claims 1 to 11, wherein~~spectacle and contact lens selecting
system set, the wearing state display means comprises: unit
preferably includes an image acquisition meansunit for
acquiring an image of the user₇, and an image synthesizing
meansunit for synthesizing an image of spectacles or contact
20 lenses to be selected and the acquired image of the user.

A spectacle and contact lens selecting method ~~set forth~~
~~in claim 13~~according to another preferred embodiment of the
present invention, ~~comprises~~ includes the steps of: inputting
information related to a state of eyes of a user₇, deciding an
25 eyeball optical model corresponding to the information related

to the state of the eyes input by the input step τ , examining optical performance of an eyeball within a range of accommodation of the user in the eyeball optical model decided by the step of deciding the eyeball optical model, to
5 determine the range of accommodation of the eyeball τ , examining optical performance when the user wears spectacles or contact lenses to select a lens power τ , and generating and displaying a wearing state of the spectacles or the contact lenses to be selected.

10 ~~The spectacle and contact lens selecting method set forth in claim 14 of~~In the present invention is recited in claim 13,
~~wherein~~the spectacle and contact lens selecting method, the input
~~step comprises~~preferably includes the step of inputting information ~~of~~about the eyes of the user, such as a wearing
15 condition of the user, an age, a near point distance, a far point distance, or a vision at a constant distance.

~~The spectacle and contact lens selecting method set forth in claim 15 of~~In the present invention is recited in claim 13
~~or 14, wherein~~the spectacle and contact lens selecting method, the
20 ~~step of deciding the eyeball optical model comprises~~preferably includes the step of deciding a start eyeball optical model based on the information of the eyes of the user, such as an age and an approximated lens power.

~~The spectacle and contact lens selecting method set forth~~
25 ~~in claim 16 of~~In the present invention is recited in any one

~~of claims 13 to 15, wherein~~ spectacle and contact lens
selecting method, the step of deciding the eyeball optical
model ~~comprises~~ preferably includes the step of deciding the
eyeball optical model ~~as such~~ that at least one of a focal
5 state in the eyeball of the user at an accommodation midpoint
calculated from a near point distance and a far point distance
of the user ~~becomes optimal and/or~~ a focal state in the
eyeball of the user in a non-accommodative state calculated
from the far point distance of the user ~~becomes optimal~~ is
10 optimized.

The spectacle and contact lens selecting method ~~set forth~~
~~in claim 17 of the present invention is recited in any one of~~
~~claims 13 to 16,~~ preferably further comprising includes the step
of examining validity of the eyeball optical model at a limit
15 of accommodation on at least one of a near point side and/or
~~on a far point side~~.

~~The~~ In the spectacle and contact lens selecting method
~~set forth in claim 18 of the present invention is recited in~~
~~any one of claims 13 to 17, wherein,~~ the step of determining
20 the range of accommodation of the eyeball ~~comprises~~ preferably
includes the step of determining a range of accommodation of
optical dimensions of the eyeball at an accommodation midpoint.

The spectacle and contact lens selecting method ~~set forth~~
~~in claim 19 of the present invention is recited in any one of~~
25 ~~claims 13 to 18,~~ preferably further comprising includes the step

of generating and displaying an image of an eyeball optical model in which the range of accommodation of the eyeball is determined.

The spectacle and contact lens selecting method ~~set forth~~
5 ~~in claim 20 of the present invention is recited in any one of~~
~~claims 13 to 19,~~ preferably further comprising includes the step
of examining focal performance of the eyeball optical model at
a near point or a position within a range of accommodation
ability in the vicinity of the near point, at a far point or a
10 position within the range of accommodation ability in the
vicinity the far point, or at a position away from the near
point and the far point in a naked eye state of the user.

~~The~~ In the spectacle and contact lens selecting method
~~set forth in claim 21 of the present invention is recited in~~
15 ~~claim 20, wherein,~~ the step of examining the focal performance
of the eyeball optical model ~~comprises~~ preferably includes the
step of examining a focal state of the eyeball optical model
of the user at the near point or the position within the range
of accommodation ability in the vicinity of the near point, at
20 the far point or the position within the range of
accommodation ability in the vicinity of the far point, or at
the position away from the near point and the far point after
vision correction with the spectacles or the contact lenses.

The spectacle and contact lens selecting method ~~set forth~~
25 ~~in claim 22 of the present invention is recited in any one of~~

~~claims 13 to 21,~~preferably further comprising~~includes~~ the step of generating a visibility sharpness score of visibility of the user at at least one of before and/or after vision correction with the spectacles or the contact lenses.

5 The spectacle and contact lens selecting method ~~set forth in claim 23 of~~preferably further includes the step of generating an image to be viewed by the user at at least one of before and after vision correction with the spectacles or the contact lenses.

10 In the present invention is recited in any one of claims 13 to 22, further comprising the step of generating an image to be viewed by the user before and/or after vision correction with the spectacles or the contact lenses.

~~The spectacle and contact lens selecting method set forth in claim 24 of the present invention is recited in any one of~~
15 ~~claims 13 to 23, wherein,~~ the step of generating and displaying the wearing state ~~comprises,~~preferably includes the step of acquiring an image of the user~~;~~, and the step of synthesizing an image of spectacles or contact lenses to be
20 selected and the acquired image of the user.

 The above and other elements, steps, characteristics, features and advantages of the present invention will be apparent from the following detailed description of preferred embodiments of the present invention with reference to the
25 accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a diagram showing an example of a system configuration of a spectacle and contact lens selecting system
5 ~~in an~~ according to a preferred embodiment of the present invention;

Fig. 2 is a diagram showing ~~the schema of a~~ process when a user purchases spectacles or contact lenses;

Fig. 3 is a diagram showing ~~the schema of a~~ process of
10 categorizing the user in the process of the spectacle and contact lens selecting system;

Fig. 4 is a diagram showing ~~the schema in the case a~~ process where the user is a returning customer;

Fig. 5 is a diagram showing ~~the schema of a~~ process in
15 ~~the case where~~ the user is not a customer but has a prescription;

Fig. 6 is a diagram showing ~~the schema of a~~ process in
~~the case where~~ the user is not a customer, does not have a prescription, and ~~is not destined~~ does not intend to wear a
20 pair of spectacles for presbyopia;

Fig. 7 is a diagram showing ~~the schema of a~~ process in
~~the case where~~ the user is not a customer and does not have a prescription with no subjective symptom of presbyopia;

Fig. 8 is a diagram showing ~~the schema of a~~ process in
25 ~~the case~~ where the user prefers a pair of ready-made

spectacles for presbyopia;

Fig. 9 is a view showing a lens selection criterion database;

Fig. 10 is a view showing a lens database;

5 Fig. 11 is a schematic view of a screen at the top of a site;

Fig. 12 is a schematic view of a collecting screen of personal computer screen information;

10 Fig. 13 is a schematic view of a service selection screen;

Fig. 14 is a schematic view of a screen at the top of frame selection;

Fig. 15 is a schematic view of a PD measurement screen;

15 Fig. 16 is a schematic view of a facial image selection screen;

Fig. 17 is a schematic view of a self-portrait upload screen;

Fig. 18 is a schematic view of a virtual frame selection screen;

20 Fig. 19 is a schematic view of a different color display screen;

Fig. 20 is a schematic view of a saved-item confirmation screen;

25 Fig. 21 is a schematic view of a purchased frame confirmation screen;

Fig. 22 is a schematic view of a lens power selection screen for having spectacles made;

Fig. 23 is a schematic view of a prescription data entry screen;

5 Fig. 24 is a schematic view of a lens thickness comparison screen;

Fig. 25 is a diagram showing an example of a configuration of a lens virtual try-on system equipped for the spectacle and contact lens selecting system ~~in an~~ according to
10 a preferred embodiment of the present invention;

Fig. 26 is a view showing an example of a database related to user information;

Fig. 27 is a view showing an example of data input by frame selection information input ~~means~~ unit;

15 Fig. 28 is a view showing an example of a database structure related to a functional structure of a frame;

Fig. 29 is a view showing an example of a database structure related to a decorative structure of a frame;

Fig. 30 is a schematic view showing a measurement method
20 on the lateral side of a facial image;

Fig. 31 is a schematic view showing a measurement method on the front side of the facial image;

Fig. 32 is a schematic view showing a frame adjusting method;

25 Fig. 33 is a view showing an example of a configuration

of a remote subjective vision test system equipped for the
spectacle and contact lens selecting system in the preferred
embodiment of the present invention;

Fig. 34 is a flowchart of screens for lens power decision
5 (No. 1);

Fig. 35 is a flowchart of screens for lens power decision
(No. 2);

Fig. 36 is a schematic view of a personal computer screen
information collecting screen;

10 Fig. 37 is a schematic view of a user information entry
screen;

Fig. 38 is a schematic view of a wearing condition entry
screen;

Fig. 39 is a schematic view of a guidance screen
15 displayed at an astigmatism axis measurement step 1;

Fig. 40 is a schematic view of an astigmatism axis
determination chart displayed at an astigmatism axis
measurement step 2;

Fig. 41 is a view showing a state of the user at an
20 astigmatism axis measurement step 3;

Fig. 42 is a view showing a state of the user at an
astigmatism axis measurement step 4;

Fig. 43 is a schematic view of a far point distance
measurement target displayed at a far point distance
25 measurement step 1;

Fig. 44 is a view showing a state of the user at a far point distance measurement step 2;

Fig. 45 is a view showing a state of the user at a far point distance measurement step 3;

5 Fig. 46 is a view showing a state of the user at a far point distance measurement step 4;

Fig. 47 is a view showing a state of the user at a far point distance measurement step 5;

Fig. 48 is a view showing an example how the far point distance measurement target is viewed at a far point distance measurement step 5-1;

Fig. 49 is a view showing a state of the user at a far point distance measurement step 7;

Fig. 50 is a preparatory state for executing a near point distance measurement;

Fig. 51 is a schematic view of a near point distance measurement target displayed at a near point distance measurement step 1;

Fig. 52(A) is a view showing a state of the user at a near point distance measurement step 2, and Fig. 52(B) is a view showing a state where a target is viewed with blur;

Fig. 53(A) is a view showing a state of the user at a near point distance measurement step 3, and Fig. 53(B) is a view showing a state where a target is viewed clearly;

25 Fig. 54 is a view showing a state of the user at a near

point distance measurement step 4;

Fig. 55 is a view showing a state of the user at a near point distance measurement step 5;

Fig. 56 is a view showing a state of the user at a near point distance measurement step 6;

Fig. 57 is a view showing a state of the user at a near point distance measurement step 7;

Fig. 58 is a view showing a state of the user at a near point distance measurement step 8;

Fig. 59 is a schematic view of a near point distance measurement target displayed at a near point distance measurement step 9;

Fig. 60 is a view showing a state of the user at a near point distance measurement step 10;

Fig. 61 is a diagram showing an example of a configuration of an optometry system equipped for the spectacle and contact lens selecting system in accordance to a preferred embodiment of the present invention;

Fig. 62 is a view showing an example of a process flow of the optometry system;

Fig. 63 is a view showing an example of display of a personal information entry screen;

Fig. 64 is a view showing an example of display of a wearing condition entry screen;

Fig. 65 is a view showing an example of display of an

explanatory screen for astigmatism axis determination;

Fig. 66 is a view showing an example of display of an astigmatism axis determination screen;

Fig. 67 is a view showing an example of display of an explanatory screen of a far point vision test;

Fig. 68 is a view showing an example of display of a far point vision test screen;

Fig. 69 is a view showing an example of display of an explanatory screen of near point distance measurement;

Fig. 70 is a view showing an example of a near point distance measurement screen;

Fig. 71 is a view showing an example of a configuration of a neural network for far point distance calculation;

Fig. 72 is a view showing an example of a configuration of a lens power decision system equipped for the spectacle and contact lens selecting system in accordance to a preferred embodiment of the present invention;

Fig. 73 includes schematic views, each showing a target for testing a far point vision where (a) shows the largest target, (b) shows a medium-sized target, and (c) is the smallest target;

Fig. 74 is a schematic view showing an eyeball optical model;

Fig. 75 is a flowchart showing an operation of a corrective lens deciding server according to a preferred

embodiment of the present invention;

Fig. 76 is a view showing a example of a relation between a sharpness score and a view; and

Fig. 77 is a view showing a example of a screen for
5 confirming an image viewed before and after vision correction.

DETAILED DESCRIPTION OF PRFERRED EMBODIMENTS

Fig. 1 is a view showing an example of a system configuration of a spectacle and contact lens selecting system
10 ~~in an~~according to a preferred embodiment of the present invention. In ~~the drawing~~Fig. 1, the reference numeral 1 denotes a user client, the reference numeral 2 denotes a spectacle order/sales service center, and the reference numeral 3 denotes an external payment transaction agency. They
15 are physically connected to each other via a network. In the following description, ~~it is assumed that the network~~ connecting the user client 1, the spectacle order/sales service center 2, and the external payment transaction agency 3 is preferably the Internet.

20 The user client 1 is a terminal used when a purchaser of spectacles makes an order for sales through the network₇, for example, a personal computer having a network connection-
~~function is used for it~~. The user client 1 is an input/output device serving as an interface with the user who uses it.

25 Although a general keyboard or mouse is used as the input

device for inputting information, a dedicated input device
such as a pointing device, such as a track ball or a joystick,
a touch panel, and a switch may be provided. As an image
display device, a general CRT display or a liquid crystal
5 monitor is preferably used. Furthermore, this user client 2001
includes an image input device for acquiring prescription data
as image information. Although a digital camera 11a and a
scanner 11b are preferably used as the image input device, any
devices capable of digitizing and inputting image information,
10 such as a video camera or a television camera may be used. The
user client 1 also includes a WWW browser 12 as an interface
for ~~making an~~ providing access to the spectacle order/sales
service center 2 ~~to get a service therefrom~~.

The spectacle order/sales service center 2 is a server
15 for providing the user client 1 who is connected through the
Internet with a service to sell spectacles fitted to their
vision or in accordance with requests of each user ~~on to~~
~~order, it is composed of~~. The spectacle order/sales service
center 2 includes information processing equipment, such as a
20 personal computer or a work station having a network
connection function, and is connected to the user client 1
through the Internet. The spectacle order/sales service center
2 includes ~~an~~ an electronic shop information processing
~~means~~ unit 21, a display information generating means unit
25 22, a spectacle order/sales processing means unit 23, a

payment transaction ~~means~~unit 24~~+~~, a WWW server/CGI 25~~+~~, a lens selecting ~~means~~unit 26~~+~~, a frame selecting ~~means~~unit 27~~+~~, and a lens power deciding ~~means~~unit 28.

The electronic shop information processing ~~means~~unit 21
5 defines item data, such as spectacle lenses and frames sold by the spectacle order/sales service center 2 using an item defining section 211 through the input/output device. The item data defined herein is stored in an item database as item data information.

10 In this preferred embodiment, the item data information ~~contains~~includes text data, such as a name of a shelf on which items such as frames are displayed, an item number of a spectacle lens or frame ~~or the like~~, an item name, a price, the description of an item, and item management information~~+~~,
15 image data of an item, such as a frame and ~~the like~~other useful information. The spectacle order/sales service center 2 also includes an input/output device serving as an interface with a creator of an electronic catalog. The input/output device receives the input of the item information, such as
20 text data such as a shelf name, an item category and a price that are necessary for defining an item or image data indicating a shape of an item from the catalog creator. Moreover, this input/output device outputs information ~~containing~~including item information, such as an item number
25 and the number of items, delivery destination information of

an item, payment information such an external payment transaction agency name, a payment date, and the sum as order information of an item purchased by the user.

An electronic shop opening information database
5 ~~containing~~including a shop database, an item database, and a
basket database is provided for the electronic shop
information processing ~~means~~unit 21. The shop database stores
information for opening an electronic shop and information for
defining a shop layout to display the item information. The
10 item database stores the defined item data information. The
basket database is for accumulating information of an item
~~directed~~selected by the user client 1 to be purchased. The
electronic shop information processing ~~means~~unit 21
~~realizes~~performs a function of storing the transferred item
15 data information in the item database.

The display information generating ~~means~~unit 22 generates
display information, such as the electronic catalog in
response to a request from the user client 1. The display
information generating ~~means~~unit 22 ~~is composed so as to~~
20 ~~include~~includes a parameter analyzing ~~means~~unit 221, a file
search ~~means~~unit 222, and a display data generating ~~means~~unit
223. The parameter analyzing ~~means~~unit 221 analyzes vision
test data and frame selection information ~~and the like~~
received from the user client 1 through the WWW server/CGI 25
25 so as to extract a parameter ~~contained~~included in the vision

test data and frame selection information ~~and the like~~. The
file search ~~means~~unit 222 ~~makes a search in~~searches each
database registered and stored by the electronic shop
information processing ~~means~~unit 21 based on the parameter
5 extracted by the parameter analyzing ~~means~~unit 221. The
display data generating ~~means~~unit 223 generates display data
that ~~can be~~is displayed as a WWW page based on the data
searched by the file search ~~means~~unit 222. More specifically,
the display data generating ~~means~~unit 223 ~~has a~~
10 ~~function~~functions as a ~~so-called~~ WWW page generator.

The spectacle order/sales processing ~~means~~unit 23
receives a customer ID and an ID of an item to be purchased
from the display information generating ~~means~~unit 22 when the
item to be purchased (a spectacle lens, a frame or the like)
15 is ~~decided~~selected by the user client 1 so as to acquire
detailed information of the item to be purchased from the item
database based on ~~these~~this information. Then, it stores
information of the item in a customer basket database for a
target customer in the basket database. Thereafter, a list of
20 items to be purchased by the target customer is acquired from
the basket database so as to be ~~passed~~transmitted to the
display information generating ~~means~~unit 22.

The payment transaction ~~means~~unit 24 receives the
customer ID from the display information generating ~~means~~unit
25 22 when the item is ~~decided~~selected to be purchased by the

user client 1 so as to ~~fetch~~retrieve item data information
corresponding to the user from the basket database. Then, it
requests the external payment transaction agency 3 to transact
the payment based on the ~~fetch~~retrieved item data
5 information. The payment transaction ~~means~~unit 24 is notified
of completion of the payment transaction by the external
payment transaction agency 3 so as to inform the spectacle
order/sales processing ~~means~~unit 23 and the electronic shop
information processing ~~means~~unit 21 of completion of the order
10 process. At the same time, it creates itemization data for
informing the user client 1 of a purchasing process so as to
deliver the data to the display information generating
~~means~~unit 22.

The WWW server/CGI 25 acts as an interface with the user
15 client 1 so as to receive display request information from the
user client 1 and to transfer display data to the user client
1.

The frame selecting ~~means~~unit 27 selects a frame
~~desired~~selected by the user from the frames displayed in a
20 virtual store. In this case, a frame selecting process
described in a spectacle virtual try-on system described below
is executed ~~so~~such that the user can select a frame while
watching an image of the user wearing a potentially purchased
frame.

25 The lens power deciding ~~means~~unit 28 remotely tests ~~a~~the

vision of the user to ~~decide a power~~ determine the power of a corrective lens. In this case, a vision test using an eyeball optical model ~~described for~~ a remote subjective vision test system described below is executed so as to ~~decide a~~
5 accurately determine the power of a corrective lens ~~with good~~
~~accuracy~~.

The lens selecting ~~means~~ unit 26 selects a lens fitted to the user in consideration of the results of the vision test, a budget, and the functions of a lens, ~~and the like~~.

10 The external payment transaction agency 3 provides a payment service for the ordered spectacles ~~in place of~~ for the spectacle order/sales service center 2 based on a request sent from the payment transaction ~~means~~ unit 24 of the spectacle order/sales service center 2.

15 Next, the schematic operations of the user client 1 and the spectacle order/sales service center 2 will be described.

In the spectacle order/sales service center 2, the WWW server/CGI 25 receives spectacle order page information sent from the user client 1 so as to activate the display
20 information generating ~~means~~ unit 22.

Upon activation, the display information generating ~~means~~ unit 22 receives the spectacle order page information from the WWW server/CGI 25 ~~so such~~ that the parameter analyzing ~~means~~ unit 221 analyzes the received spectacle order
25 page information. The parameter analyzing ~~means~~ unit 221

outputs information, such as a shop ID for specifying an electronic shop to be displayed, a catalog template for specifying the type of a background screen of an electronic catalog, an item ID of an item to be displayed, and a customer ID for identifying a user, ~~and the like~~ as the results of analysis. Based on these data output from the parameter analyzing ~~means~~unit 221, the file search ~~means~~unit 222 ~~makes a search~~ searches in the shop database, the item database, and the basket database so as to acquire data ~~needed~~required to create a display screen requested by the user client 1.

After ~~the~~ acquisition of the data by the file search ~~means~~unit 222, the process proceeds to the display data generating ~~means~~unit 223. The display data generating ~~means~~unit 223 first determines the type of the request from the user client 1. If the request from the user client 1 is other than "~~decision~~selection of an item to be purchased" or "purchase of an item," the display data generating ~~means~~unit 223 uses the results of a search to create data for display by the file search ~~means~~unit 223.

As a result of determination at the step of determining the type of the request from the user client 1, if the type of the request from the user client 1 is "determination of an item to be purchased," that is, if the customer ~~directs~~instructs to "add a selected item into the shopping basket" so as to indicate that the displayed item will be

purchased, the display data generating ~~means~~unit 223 activates the spectacle order/sales processing ~~means~~unit 23.

Upon activation, the spectacle order/sales processing ~~means~~unit 23 receives the customer ID and the item ID of the
5 item ~~directed~~selected to be purchased by the customer from the display data generating ~~means~~unit 223. Then, it acquires detailed item data information for the corresponding item from the item database using the item ID as key information. Then, the item data information acquired at the above-described step
10 is stored in the customer basket database of the customer identified by the customer ID received from the display data generating ~~means~~unit 223 in the basket database. At this time, if the corresponding customer basket database does not exist, a customer basket database corresponding to the customer ID is
15 created so as to store the item data information therein. Furthermore, it ~~fetches out~~retrieves all of the item data information selected by the user ~~by then~~ from the customer basket database so as to deliver it to the display data generating ~~means~~unit 223. In this case, the display data
20 generating ~~means~~unit 223 creates a list of display information of items to be purchased by the customer from the item data information received from the spectacle order/sales processing ~~means~~unit 23 so as to send it to the user client 1. ~~The~~At
this time, the customer can confirm the items to be purchased
25 or cancel a part ~~of~~ or all of the items to be purchased based

on the information displayed ~~at this time.~~

As a result of the determination at the step of determining the type of the request from the user client 1, if the type of the request from the user client 1 is "purchase of an item," that is, if the customer ~~directs~~ makes the decision ~~of to purchase of the items selected by then,~~ the display data generating ~~means~~ unit 223 activates the payment transaction ~~means~~ unit 24 prior to creation of display data.

Upon activation, the payment transaction ~~means~~ unit 24 receives the customer ID from the display data generating ~~means~~ unit 223. The payment transaction ~~means~~ unit 24 searches the item data information of the items to be purchased, which is stored in the customer basket database of the customer identified by the customer ID from the basket database. Based on the item data information obtained as a result of the search, the external payment transaction agency 3 is requested to make a payment transaction. In response to this request, the external payment transaction agency 3 provides a payment transaction service in place of the spectacle order/sales service center 2 and then notifies the spectacle order/sales service center 2 of completion of the payment transaction at its completion. Since the payment transaction carried out by the external payment transaction agency 3 is not ~~particularly~~ substantially different from a conventional one, the detailed description thereof is ~~herein-omitted~~ herein.

When the payment transaction ~~means~~unit 24 is notified of the completion of the payment transaction from the external payment transaction agency 3, it transfers order information including information related to the ordered item, such as an
5 item number and the number of ordered items, delivery destination information indicating destination of the item, and payment information ~~consisting of~~including a name of the external payment transaction agency 3 executing the payment transaction, a payment date, and sum information ~~and the like~~
10 to the spectacle order/sales service center 2. In the spectacle sales service center 2, the order information received from the WWW server/CGI is displayed by the input/output device. Finally, the payment transaction ~~means~~unit 24 creates itemization data for notification of the
15 completion of the payment transaction and ~~passes~~transmits it to the display data generating ~~means~~unit 223. The display data generating ~~means~~unit 223 uses the received itemization data to create a display screen for notification of the completion of the payment transaction and ~~then to transfer~~ it to the user
20 client 1.

Next, a method of ordering and selling spectacles by the spectacle and contact lens selecting system will be described below.

Fig. 2 is a view showing ~~the schema of a process when in~~
25 which the user purchases spectacles or contact lenses. As

illustrated, if the user wants to select a frame, a frame is selected, if the user wants to test his/her vision, an uncorrected vision and a corrected vision are tested. If the user wants to select a lens, a lens is selected. In response to notification of payment in advance or part payment from the payment transaction, spectacles or contact lenses are processed or assembled based on the information of the selected frame and the selected lenses and the result of the vision test. Then, the item is delivered to the user cash on delivery. Although the process is herein described as proceeding in the order of the selection of a frame, the vision test, and the selection of a lens, it is sufficient to carry out only the processes ~~needed~~required by a ~~the~~ request of the user and the order thereof may be arbitrary. For example, a ~~vision may be first tested~~ first. Then, a lens may be selected, and a frame may be selected at the final step. If the user only wants to change a lens power, only a vision test may be ~~carried out so~~ performed such that a lens or a frame can be selected based on the customer database. If the user only wants to replace a frame, only a frame may be selected ~~so~~ such that a vision may be determined or a lens may be selected based on the customer database.

Figs. 3 to 8 show ~~the schema of the a~~ process of the spectacle and contact lens selecting system. Fig. 3 is a view showing ~~the schema of a~~ process for first categorizing the

user₇. Fig. 4 is a view showing ~~the schema of a process in the~~
~~case~~ where the user is a returning customer₇. Fig. 5 is a view
showing ~~the schema of a process in the case~~ where the user is
not a customer but has a prescription₇. Fig. 6 is a view
5 showing ~~the schema in the case a process~~ where the user is not
a customer, does not have a prescription, and ~~is not~~
~~destined~~does not intend to wear a pair of spectacles for
presbyopia₇. Fig. 7 is a view showing ~~the schema in the case a~~
process where the user is not a customer and does not have a
10 prescription with no subjective symptom of presbyopia₇ and.
Fig. 8 is a view showing ~~the schema in the case a~~ process where
the user prefers a pair of ready-made spectacles for
presbyopia.

First, when the spectacle order/sales service center 2
15 accepts the connection from the user client 1, it transmits a
basic attribute entry screen for prompting input of basic
attributes, such as a name, the date of birth and a telephone
number. The user client 1 receives and displays the basic
attribute entry screen so as to transmit the basic attributes
20 input by the user to the spectacle order/sales service center
2. The spectacle order/sales service center 2 receives the
input basic attributes so as to search the customer database
by the spectacle order/sales processing ~~means~~ unit 23.

If, as a result of the search, it is determined that the
25 user is a customer who has already purchased spectacles ~~as a~~

~~result of the search~~, the process proceeds to Fig. 4 where an inquiry screen for confirming the ~~intension~~-desires of the user is transmitted to the user client 1. If the user selects "I select the same lenses as the previous ones and the same
5 frame as the previous one" on the inquiry screen, lenses are created based on the vision test data, the frame information data, and the lens information data managed by the customer database (basket database). If the user ~~desires~~-wants to get new lenses and/or a new frame on the inquiry screen, a step
10 selecting screen for transition to a "lens power deciding step," a "frame selecting step," and a "lens selecting step" is transmitted to the user client 1. If the user selects "I don't want the same lens power as the previous one" on the selection screen, the "lens power decision step" is ~~carried-~~
15 ~~out-performed~~. If "I select new frames," the "frame selecting step" is ~~carried out-performed~~. If "I select new lenses," the "lens selecting step" is ~~carried out-performed~~. At the "lens power deciding step" in this case, a "remote vision test system" described below is ~~carried out-performed~~. At the
20 "frame selecting step", an inquiry screen for making an inquiry whether a spectacle wearing virtual try-on is ~~carried-~~
~~outperformed~~ or not is transmitted to the user client 1. If the user selects "I try the spectacles on," the "spectacle virtual try-on system" is ~~carried outperformed~~.

25 If he/she is not a customer, a prescription confirmation

screen for ~~making an inquiry~~inquiring whether he/she has a prescription from an ophthalmologist or not is transmitted to the user client 1. If the user selects "I have a prescription from a doctor" on the prescription confirmation screen, the process proceeds to Fig. 5 where a prescription entry guidance screen is transmitted to the user client 1. The user inputs the prescription as image data from a scanner in accordance with the guidance of the screen or as text data from the keyboard so as to transmit it to the spectacle order/sales service center 2. Then, as in the above-described case, the step selecting screen for the transition to the "lens power deciding step," the "frame selecting step," and the "lens selecting step" is transmitted to the user client 1 so as to execute each of the processes in response to the request of the user.

If the user selects "I don't have a prescription," an inquiry screen for making an inquiry whether the age of the user exceeds 40 through 45 years old or not is transmitted to the user client 1. If the user selects "I am 40 through 45 years old or below" on the inquiry screen, the process proceeds to Fig. 6 where the step selecting screen for transition to the "lens power deciding step," the "frame selecting step," and the "lens selecting step" is transmitted to the user client 1 so as to execute each of the processes in response to the request of the user.

If the user selects "I am older than 40 through 45 years old," an inquiry screen whether he/she has the subjective symptom that he/she cannot clearly see in the vicinity of his/her hands or not is also transmitted to the user client 1.

5 If the user selects "I don't have any subjective symptoms" on the inquiry screen, the process proceeds to Fig. 7 where the step selecting screen for transition to the "lens power deciding step," the "frame selecting step," and the "lens selecting step" is transmitted to the user client 1 so as to
10 execute each of the processes in response to the request of the user. In this case, since there is a possibility that he/she ~~may be presbyope~~ has presbyopia in view of the age of the user, a "step of selecting the type from ~~longsightedness~~ farsightedness, shortsightedness and bifocals" is executed.
15

If the user selects "I have a subjective symptom," the spectacle order-sales service center 2 determines that the user ~~is presbyope~~ has presbyopia and transmits an inquiry screen for ~~asking~~ inquiring if he/she prefers custom-made
20 spectacles for presbyopia or not to the user client 1. If the user selects "I prefer custom-made spectacles" on the inquiry screen, the process proceeds to Fig. 7 where the step selecting screen for transition to the "lens power selecting step," the "frame selecting step," and the "lens selecting
25 step" is transmitted to the user client 1 to execute each of

the processes in accordance with the request of the user. In this case, the "step of selecting from spectacles for ~~longsightedness~~farsightedness, shortsightedness, and bifocals" is further executed.

5 If the user selects "I prefer ready-made spectacles for presbyopia," the process proceeds to Fig. 8 so as to decide a lens power determined from the age of the user and then to transmit the step selecting screen for transition to the "frame selecting step" and the "lens selecting step" to the
10 user client to execute each of the processes in response to the request of the user.

 Although it is described in the above process that the basic information of the user is first input, a user ID and a password may be issued to the user who has registered the
15 basic information in advance so as to enter the user ID and the password when the user connects from the user client 1 to the spectacle order/sales service center 2 for authentication. In this case, it can be determined based on the user ID whether the user is a customer who has already purchased
20 spectacles or not.

 Next, a ~~way~~method of providing a service will be specifically described by using an example of a screen displayed on the user client 1.

 First, the spectacle order/sales service center 2 first
25 transmits a screen at the top of a site (Fig. 11) to the user

client 1 and subsequently transmits a personal computer screen information collecting screen (Fig. 12) to the user client 1 so as to instruct the purchaser to enter display (monitor) information, such as ~~a~~the resolution and size of the personal computer screen, thereby acquiring the display information input by the user client 1.

Next, on a service selecting screen (Fig. 13) transmitted from the spectacle order/sales service center 2, the user clicks any one of the "remote subjective vision test step (World first! Self-check spectacle lens power identification system)," the "frame selecting system (Try various spectacles on! Frame fitting room)," the "lens selecting step (Use lenses without vision correction)," and the "prescription supply step (Use prescription data from an ophthalmologist or data of a spectacle store card)" so as to transmit the ~~intension~~intent of the user from the user client to the spectacle order/sales service center 2.

When lens selection criteria ~~of lenses become clear~~is determined at the remote subjective vision test step or the prescription supply step, the process proceeds to the lens selecting step.

Next, the lens selecting step will be described.

When the user decides to use the most recent vision data and therefore clicks "Select the same lenses as the previous ones," when the user decides to have spectacles made based on

prescription data from a doctor and therefore clicks "Select lenses in accordance with the prescription," or when the user determines to purchase ready-made spectacles for presbyopia and therefore clicks "Select ready-made spectacles for
5 presbyopia," the lens selecting ~~means~~unit 26 selects lenses based on the respective data.

If the user wants to remotely test his/her vision even though he/she has the most recent vision data or a prescription from a doctor, the user proceeds to the remote
10 vision test step by the vision deciding ~~means~~unit 28 so as to test his/her vision.

Although various lenses are registered as a database (Figs. 9 and 10) in the spectacle order/sales service center 2, the lens selecting ~~means~~unit 26 transmits a lens selection
15 screen, on which a lens satisfying the request of the user input from the user client 1 or a lens recommended by the spectacle order/sales service center 2 to the user is displayed from them, to the user client 1 based on the most recent vision data, the prescription from a doctor, or data
20 obtained by testing with the remote vision test system. Moreover, if the user is a returning customer, the previously purchased lenses are also displayed on the lens selection screen.

As choices in the selection of lenses, a manufacturer
25 name, a model, a purpose of use, lens functions (a lens

thickness, a lens weight, endurance, UV protection), a color, a price, and a lens power ~~and the like are~~ provided. The user specifies these options to search a lens, selects a lens that he/she wants to purchase, and transmits it to the spectacle

5 order sale service center 2.

Next, the frame selecting step will be described.

For example, if data regarding ~~frame~~-functional and decorative ~~aspects~~ aspect of the frames is ~~present~~ provided in the spectacle order/sales service center 2 as in the case
10 where he/she is a returning customer, a frame can be specified in view of fashion, image, design and the like.

The frame selection in the case where the frame data in terms of functions and decoration is present in the spectacle order/sales service center 2 will be described below.

15 Frames are registered as a database in the spectacle order/sales service center 2 ~~as a database~~. The frame selecting ~~means~~ unit 27 transmits a frame selection top screen (Fig. 14), on which typical frames ~~among them~~ are displayed, to the user client 1. Then, the user answers questions in the
20 form of a questionnaire about fashion, ~~a material~~, design, ~~a~~ and budget, ~~and the like so~~ such that the frame selecting ~~means~~ unit 27 selects a frame which seems to be the most suitable based on the data indicating the ~~intensions~~ desires of the user and transmits a frame selection screen to the user
25 client 1.

The frame selection screen categorizes the spectacle frames in accordance with gender/material and displays typical frame images falling within the category.

If he/she is a returning customer, the previously
5 purchased frame is also displayed on the frame selection screen.

~~As choices~~Choices of a frame, ~~there are~~ include fashion, a-material, design, a-price, and ~~the like.~~other choices. The user reads the options to enter the desired conditions,
10 selects a frame that he/she wishes to purchase from the displayed frame images, and transmits it to the spectacle order/sales service center 2.

At this time, this system is equipped with wearing state display ~~means of unit to~~ virtually putting display the
15 selected frame on a model's face or his/her own face.

Next, ~~ana~~ a preferred embodiment of the wearing state display ~~means constituting unit according to~~ the present invention will be described using a spectacle virtual try-on system shown in Fig. 25.

20 The spectacle virtual try-on system ~~realizes~~provides a virtual experience ~~that in which the user can put~~ various spectacle frames ~~can be put~~ on a face of a model or the user, and is ~~constituted~~controlled by a user client 2001 and a spectacle order/sales service center 2002. The user client
25 2001 and the spectacle order/sales service center 2002 are

physically connected through a network. In this case, the following description will be given ~~assuming that~~ in which the network is the Internet.

The user client 2001 is a terminal used when the user
5 virtually tries spectacles on, and ~~is composed of~~ includes, for example, a personal computer having a network connection function. Although a general CRT display or liquid crystal monitor is preferably used as an image display device for displaying a spectacle wearing state, a dedicated image
10 display device such as a head mount display (HMD) or a projection-type display device may be ~~prepared~~ used. Moreover, although a general keyboard or mouse is preferably used as an input device for inputting information such as frame selection information, a dedicated input device such as a pointing
15 device such as a track ball and a joystick, a touch panel, and a switch may be prepared. Furthermore, this user client 2001 includes an image input means ~~unit~~ for acquiring a facial image of the user. Although a digital camera is preferably used in this case, any devices capable of digitizing and inputting an
20 image such as a video camera and a scanner may be used. Furthermore, the user client 2001 includes a WWW browser as an interface for ~~making an access to~~ accessing the spectacle order/sales service center 2002 so as to receive a service therefrom.

25 The spectacle order/sales service center 2002 is a server

for providing a spectacle virtual try-on service, ~~it is~~
~~composed of~~. It includes information processing equipment
such as a personal computer and a work station which has a
network connection function, and is connected to the user
5 client 2001 through the Internet. The spectacle order/sales
service center 2002 includes a WWW server ~~serving as~~ a contact
point for providing a service to the user client 2001.
Moreover, ~~it~~ the spectacle order/sales service center 2002
includes ~~a~~ a user information registering ~~means~~ unit 2003 for
10 registering user information including a facial image of the
user, ~~a~~ a frame selection information input ~~means~~ unit 2004 for
inputting selection information at the selection of a frame by
the user, ~~a~~ a database management ~~means~~ unit 2005 for
conducting access management ~~to of~~ the database, ~~a~~ a frame
15 information registering ~~means~~ unit 2060 for registering the
functional structures and the decorative structures of frames
to be sold, ~~a~~ a frame image registering ~~means~~ unit 2061 for
registering the images of frames to be sold, ~~an~~ an image
synthesizing ~~means~~ unit 2007 for synthesizing a frame image and
20 a facial image of a model or the user, ~~and a~~ a frame selecting
~~means~~ unit 2008 for selecting a corresponding frame based on
the frame selection information. ~~It~~ The spectacle order/sales
service center 2002 is connected to the WWW server through an
input ~~means~~ unit 2006 and an output ~~means~~ unit 2009. Each of the
25 ~~means~~ units is activated by a CGI of the WWW server as needed

required so as to provide a spectacle virtual try-on service to the user client 2001. Moreover, the WWW server has a user authentication function for authenticating that the user client 2001 is a legitimate user.

5 The database managed by the database management ~~means~~unit 2005 includes a user information database, a frame selection information database, a frame functional structure database, and a frame decorative structure database as shown in Figs. 26 to 29.

10 Next, a process ~~procedure~~ for providing a spectacle virtual try-one service by this system to the user will be described.

 First, a service provider activates the frame information registering ~~means~~unit 2060 to input functional structure data
15 and decorative structure data of spectacles to be sold by the keyboard ~~and the like~~or other suitable input device so as to register them on the databases.

 As shown in Fig. 28 the frame functional structure data of each frame includes a size or an actual size (44Ø - 62Ø),
20 and features such as a shape-memory alloy, super-light weight, super-elasticity, simultaneous function as sunglasses, portability and so forth. Also included are functions such as the distance between the right and left pupils, the widths from the center of the right and left pupils to the feet of
25 the ears, the opening angles of temples determined based on

the widths from the center of the right and left pupils to the feet of the ears, the distances from the feet of the ears to the tops of the corneas, the bending positions of the temples, the distances between the tops of the corneas and the foot of the nose, and the opening angles of pad bridges determined based on the distances between the tops of the corneas and the foot of the nose. As shown in Fig. 29, the frame ornamental structure data includes ~~as-shapes~~, such as Wellington, Lloyd, Oval, Square, Tonneau, Boston, Butterfly, and Auto (Drop).

Materials are rimless (two-point, three-point), metal + nylon rimmed, celluloid + nylon rimmed, metal, celluloid, brow-line, combination and so forth. Brands include various brands, and colors include various colors.

The frame image registering ~~means~~unit 2061 is also activated to input images of the frames of spectacles to be sold from the scanner ~~or the like~~ so as to register them on the database.

Next, when the user ~~makes an access to~~ accesses the WWW server by using the WWW browser of the user client 2001, the WWW server transmits a user authentication screen. The user authentication screen instructs ~~ana~~ a user to input ~~of~~-user authentication information, such as a user ID and a password. If the user authentication has already been completed at the previous step, it ~~is~~ need not ~~required to be~~ executed again and therefore is skipped.

The database management ~~means~~unit 2005 makes a search in the user information database ~~by~~using the input user authentication information so as to execute the authentication.

If a service is provided for the user for the first time,
5 the user information registering ~~means~~unit 2003 is activated to transmit a basic attribute entry screen to the user client 2001. After the user enters the user's basic attributes, for example, name, address, date of birth, telephone number, eye function (he/she cannot see clearly ~~see~~in the area around
10 his/her hands ~~or the like~~, etc.), requirements for spectacles ~~and the like~~ in accordance with the screen, a user ID and a password are issued to the corresponding user ~~so~~ such that the received basic attribute information of the user is registered on the user information database.

15 At the completion of the user authentication, the frame selection information input ~~means~~unit 2004 is activated ~~so~~ such that a frame selection information entry screen ~~serving~~instructing the user to input frame selection information is transmitted to the user client 2001. The frame
20 selection information entry screen is for inputting criteria (fashion, a budget, functions, fitness to the face ~~and the like~~, etc.) for selection of a frame by the user. The user inputs frame selection criteria such as fashion, a budget, functions, and the fitness ~~to~~ to the face on the frame selection
25 information entry screen.

Next, a PD measurement screen (Fig. 15) is transmitted to the user client 2001 for measurement of the position of a pupil ~~as~~such that the pupil is positioned at the center of a lens.

5 When the entry of the frame selection criteria in the text data and the PD measurement are completed, a facial image selection screen (Fig. 16) ~~for asking~~which asks "On which face do you want to try frames?" is transmitted. If the user selects "Use a model face," the process proceeds to a next
10 virtual frame selection screen. If the user selects "Use my self-portrait," a self-portrait upload screen (Fig. 17) is transmitted.

On the self-portrait upload screen, a screen ~~for asking~~which asks "Where is your picture data?" is transmitted
15 ~~as~~such that the user selects either "Use digital camera picture data" or "Use picture data obtained by a scanner." The user ~~fetches~~retrieves front and lateral (both on the right and left sides) facial images into the user client 2001 by the image input device so as to transmit them to the spectacle
20 order/sales service center 2002.

The frame selection information input ~~means~~unit 2004 receives the text data of the frame selection information and the image data (the facial images of the user) transmitted from the user client 2001 so as to register necessary
25 information on the frame selection information database in the

following manner.

(1) Based on the side images (Fig. 30) of the user, the distances (L_1) between the feet of the ears and the tops of the corneas of the user are measured separately for the left and right, and the resulting data is registered. Based on the
5 aforementioned measurements, the positions at which the temples are bent are determined separately for the left and right, and then registered.

(2) Based on the side images of the user, the distances
10 (L_2) between the tops of the corneas of the user eyes and the foot of the nose are measured, and an average value of the left and right distances is registered. The distance L_2 is usually about 12mm. Based on the above measurements, the opening angles of the pad bridges are determined and
15 registered.

(3) Based on the front image (Fig. 31) of the user, the widths (L_3) from the center of the pupils of the right and left eyes to the feet of the ears are measured separately for the left and right, and are then registered. Based on the above
20 measurements, the opening angles θ of the temples are determined separately for the left and right and are registered.

For the widths from the center of the pupils of the right and left eyes to the ears, the distance between the pupils
25 (PD) is first determined. However, the pupils cannot be

precisely detected on the user face image, and therefore the distance between the pupils (PD) is approximated, for example, from the distance (PD₁) between the left side of the left eye and the left side of the right eye.

5 The pupils cannot be detected from the face image.

Therefore, to determine the distance (L₄) between the pupil of the left eye and the left ear, the distance from the foot of the left ear to the right side of the left eye (L_a) and the distance from the foot of the left ear to the left side (L_b) of
10 the left eye are determined. Then, the distance (L₄) between the pupil of the left eye and the left ear is determined by calculating an average of them. The distance between the right eye and the right ear ~~can~~is also ~~be~~-determined in the same manner.

15 The opening angles θ of the left and right temples of the spectacle frame are adjusted, for example, by correcting and bending the temples by the amount of angle obtained from the following equation.

$$PD/2 + L_4 - L_5$$

20 where L₅ is the front size of the spectacle frame (Refer to Fig. 32).

(4) When bifocal lenses are specified, an additional bending angle of 5 degrees is provided for the angle of inclination of the lens surface. For this reason, the opening
25 angle of the pad bridges is determined and registered ~~by~~after

being corrected with the additional angle of bending.

Thus, the frame selection information input ~~means~~unit
2004 ~~perform computation~~performs computations to create
functional structure data, ornamental structure data, and face
5 image data, which are in turn stored by the database
management ~~means~~unit 2005 in conjunction with the face image
data.

At the spectacle order/sales service center 2002, the
frame information registering ~~means~~unit 2060 and the frame
10 image registering ~~means~~unit 2061 store in advance the frame
functional structure, the frame ornamental structure, and the
frame image of each frame. An appropriate frame is selected
corresponding to the functional structure data, ornamental
structure data, and face image data according to the frame
15 selection criteria transmitted from the user client 2001.

After the selection of several types of ~~frame-frames~~
conforming to the frame selection information by the frame
selecting ~~means~~unit 2008, the virtual frame selection screen
(Fig. 18) is transmitted to the user client 2001. On the
20 virtual frame selection screen, "Try various frames and save
the ones you like (up to four frames) for now" is displayed so
as to instruct the user to select frames that interest him/her.
As a result, the user can virtually try the selected frames on
~~so as to and~~ save frames that interest him/her ~~for now~~ in view
25 of the results of virtual try-on.

On the virtual frame selection screen, ~~there are search~~
criteria such as "material and price range," "material and
brand," "material and price range and brand," and the like as
search criteria.etc. are displayed. As choices for material,
5 "Plastic," "Metal," "Two-point," "Nairoll," "Combination,"
"SG," and ~~the like~~other suitable choices are displayed ~~esuch~~
that a selection can be made ~~from them~~. As choices of price
range, "5000 to 9999 yen," "10000 to 14999 yen," "15000 to
19999 yen," "20000 to 30000 yen," and ~~the like~~other suitable
10 ranges are pull-down displayed ~~esuch~~ that a selection can be
made ~~from them~~. As choices of brand, various brand names are
pull-down displayed ~~esuch~~ that a selection can be made ~~from~~
~~them. The number.~~ A maximum of four frames ~~which are~~
~~allowed~~permitted to be saved ~~is four at maximum~~. If the number
15 of frames exceeds itfour, the frames are appropriately
reselected so as to ~~put~~ delete the unnecessary ones ~~into a~~
~~dust box to delete them.~~

An image of each of the selected frames is resized and
synthesized so as to fit to the facial image of the user by
20 the image synthesizing ~~means~~unit 2007 to generate a spectacle
wearing image. Then, the generated spectacle wearing image is
transmitted to the user client 1 as ~~a~~ part of the virtual
frame selection screen (Fig. 18). At this time, lateral images
of the frame may be simultaneously displayed. Furthermore, a
25 spectacle wearing image obtained by synthesizing the image and

the lateral images of the user may be generated and displayed by the image synthesizing ~~means~~unit 2007. As a result, the user can confirm the ~~fitness~~ on the lateral faces of the frame.

If "See a different color" is selected on the virtual
5 frame selection screen, a different color display screen (Fig. 19) is transmitted to the user client 2001. On the different color display screen, all different colors of the same model are displayed to show items in different colors. If the number of frames in different colors is less than 8, a field is
10 displayed as a blank.

The user sees a spectacle wearing image displayed on the user client 2001 so as to confirm if the selected frame meets his/her requirements ~~and the face with the frame on~~.

If an image of a frame different from the desired one is
15 transmitted or it is desired to see the face with another frame ~~in this case~~, the user specifies the frame selection information again so as to transmit it to the spectacle order/sales service center 2002. As a result, another frame is selected by the same method as ~~that~~ described above. A
20 spectacle wearing image obtained by synthesizing an image of the frame selected by the user and the facial image is generated by the image synthesizing ~~means~~unit 2007 so as to be transmitted to the user client 2001 again.

Next, ~~in order that~~to enable the user ~~confirm~~to confirm
25 the frames saved on the virtual frame selection screen (Fig.

18) and the different color display screen (Fig. 19), a saved-item confirmation screen (Fig. 20) is transmitted to the user client 2001. On the saved-item confirmation screen, "Confirm the saved frames and select the one that I want to purchase" is displayed. As a result, a frame can be selected simultaneously with a virtual experience.

If the user purchases the frame confirmed through the virtual experience with color lenses, a predetermined part is clicked.

10 Next, a purchased frame confirmation screen (Fig. 21) is transmitted to the user client 2001 so as to instruct the user to confirm the type of frame and the type of lenses to be purchased. On the purchased frame confirmation screen, an image with the selected frame on, the type of frame and the type of color lenses are displayed. If he/she does not need want to purchase an item, he/she clicks "Cancel." If he/she wants to purchases ~~them~~ the item, he/she clicks "Buy."

If "Buy" is selected on the purchased frame confirmation screen, a lens power selection screen (Fig. 22) for having spectacles made is transmitted to the user client 2001. On the lens power selection screen for ~~getting~~ spectacles, the question "Which lens power data do you use for the spectacles on this order?" is ~~given~~ displayed. As choices, "Use lens power data tested on this site," "Use lenses without vision correction," and "Use prescription data from an

ophthalmologist or data of a card from a spectacle store" are displayed so as to instruct the user to make a selection from the "lens power deciding step," the "lens selection step," and the "prescription supply step."

5 If "Use prescription data from an ophthalmologist or data of a card from a spectacle store" is selected, the process proceeds to the "prescription supply step" so as to transmit a prescription data entry screen (Fig. 23) to the user client 2001. On the prescription data entry screen, "Enter a lens
10 power" is displayed so as to instruct the following input.

- PD (in mm)
- Right eye S (pull-down display of lens power data: +0.25, - 0.25, -0.50, -0.75, -1.00 and the like), C, AX (pull-down display of astigmatism axis data: $180^\circ \pm 22.5^\circ$, $135^\circ \pm 22.5^\circ$, $90^\circ \pm 22.5^\circ$, $45^\circ \pm 22.5^\circ$, $0^\circ \pm 22.5^\circ$ and the like)
15 $\pm 22.5^\circ$, $45^\circ \pm 22.5^\circ$, $0^\circ \pm 22.5^\circ$ and the like)
- Left eye S (pull-down display of lens power data: +0.25, - 0.25, -0.50, -0.75, -1.00 and the like), C, AX (pull-down display of astigmatism axis data: $180^\circ \pm 22.5^\circ$, $135^\circ \pm 22.5^\circ$, $90^\circ \pm 22.5^\circ$, $45^\circ \pm 22.5^\circ$, $0^\circ \pm 22.5^\circ$ and the like)

20 If "Use lenses without vision correction" is selected on the lens power selection screen for ~~getting~~ spectacles and if the prescription data is input on the prescription data entry screen, a lens thickness comparison screen (Fig. 24) is transmitted to the user client 2001. On the lens thickness
25 comparison screen, "Which lenses do you want for the

spectacles? Thickness is displayed in accordance with your
lens power" is displayed to ~~display~~show cross-sectional shapes
and lens prices for a "standard lens," a "thin lens," and a
"thin lens without distortion" ~~as~~such that the user can
5 compare the thicknesses of the lenses.

When the frame is selected, the process proceeds to the
payment system.

As described above, according to the spectacle virtual
try-on system, the user can put various spectacle frames on
10 the picture data. In addition, he/she can try various
spectacle frames on at home through a network, such as the
Internet, without going to a store so as to select the most
suitable frame meeting his/her own preferences. Moreover,
according to this system, since he/she can confirm
15 himself/herself with the selecting spectacle frame on while
wearing his own spectacles or contact lenses, that is, with
proper vision, a spectacle frame optimal for him/her can be
selected.

In the above-described preferred embodiment, the
20 spectacle virtual try-on system, which allows various
spectacle frames to be put on the picture data of the user as
the wearing state display ~~means~~unit, has been described.
However, not only a spectacle frame but also contact lenses
may be virtually tried on by using similar image synthesizing
25 ~~means~~-unit. In particular, with color contact lenses~~and the~~

~~like-on~~, the image of the face greatly changes. Therefore, if the image when wearing them can be confirmed, the user is assured to select suitable contact lenses.

Next, a first preferred embodiment of lens power
5 determination step is explained below by using a remote subjective vision measurement system as shown in Fig. 33. As illustrated, the remote subjective vision measurement system
10 ~~comprises~~ includes hardware of user clients 4001 and a spectacle order/sales service center 4002. These are
10 physically connected to each other via networks. The following descriptions will be given assuming that the network connecting between the user clients 4001 and the spectacle order/sales service center 4002 is the Internet.

A user client 4001 is a terminal used when the user
15 receives a vision test service. Like the above-described user client 1, a personal computer having an Internet connection function ~~and the like~~ is used as the user client.

A spectacle order/sales service center 4002 is a server for providing a vision test service and ~~is composed of~~
20 includes information processing equipment, such as a personal computer, or a work station, ~~and the like~~ having a network connection function so as to be connected to the user client 4001 through the Internet.

The spectacle order/sales service center 4002 includes a
25 WWW server 4030 serving as a contact point for providing a

service to the user. Moreover, ~~it~~the spectacle order/sales
service center 4002 includes an eyeball optical model deciding
meansunit 4204, a model validity examination meansunit 4206,
an eyeball optical dimensions-accommodation range
5 determination meansunit 4208, an eyeball optical model image
generating meansunit 4210, an eyeball optical model focal
performance examination meansunit 4212, a viewed image
generating meansunit 4214, a sharpness score generating
meansunit 4216, a lens power selecting meansunit 4218, a user
10 information management meansunit 4230, and a database
management meansunit 4232. ~~It~~The spectacle order/sales
service center 4002 is connected to the WWW server 4030
through an input meansunit 4202 and an output meansunit 4220.
Each of the meansunits is activated by a CGI of the WWW server
15 as ~~needed~~required so as to provide a vision test service to
the user client 4001. Moreover, the WWW server has a user
authentication function for authenticating that the user
client 4001 is a legitimate user.

The input meansunit 4202 inputs information ~~of~~about the
20 eyes of a subject, such as wearing conditions of the subject,
age, a near point distance, and a far point distance, ~~and the~~
~~like~~.

The eyeball optical model deciding meansunit 4204 is
designed to determine a start eyeball optical model in
25 accordance with the age of a subject and information

~~en~~regarding the ~~eye~~eyes, such as the approximate lens power.

The eyeball optical model deciding ~~means~~unit 4204 is designed to determine an eyeball optical model in accordance with such eyeball optical dimensions that the focal state of the eyeball
5 of a subject is optimized at the accommodation midpoint calculated from the near point distance and the far point distance of the subject.

The model validity examination ~~means~~unit 4206 further examines the validity of the eyeball optical model at the
10 accommodation limit on the near point side and/or the far point side.

The eyeball optical dimensions-accommodation range determination ~~means~~unit 4208 is ~~constituted~~designed so as to determine the range of accommodation of an eyeball at an
15 accommodation midpoint, and in addition displays an image of an eyeball optical model, in which the range of accommodation of the eyeball at the accommodation midpoint is determined.

The eyeball optical model focal performance examination ~~means~~unit 4212 examines a focal state of the eyeball optical
20 model at a near point or a position within the range of accommodation ability in the vicinity of the near point, at a far point or a position within the range of accommodation ability in the vicinity of the far point, or a position away from the near point and the far point in a naked eye state of
25 the subject. Furthermore, the eyeball optical model focal

performance examination ~~means~~unit 4212 examines a focal state of the eyeball optical model of the subject at a near point or a position within the range of accommodation ability in the vicinity of the near point, at a far point or a position
5 within the range of accommodation ability in the vicinity of the far point, or a position away from the near point and the far point after vision correction with spectacles or contact lenses.

The viewed image generating ~~means~~unit 4214 generates
10 visual images viewed by the subject before and/or after the correction by ~~means~~unit of a spectacle or contact lens.

The sharpness score generating ~~means~~unit 4216 derives the sharpness score of the viewing by the subject before and/or after the correction by ~~means~~unit of a spectacle or contact
15 lens.

The lens power selecting ~~means~~unit 4218 examines optical performance when the subject wears spectacles or contact lenses so as to select a lens power.

Next, a method of testing a-vision by using this remote
20 subjective vision test system will be described in accordance with a flow of Figs. 34 and 35.

After the user client 4001 ~~makes an access to~~accesses the spectacle order/sales service center 4002 to complete the user authentication, a guidance screen is transmitted to the user
25 client 4001 ~~so as to be~~and displayed.

Next, a personal computer screen information collecting screen (Fig. 36) is transmitted to the user client 4001. On the personal computer screen information collecting screen, "Give us your personal computer information; necessary to get
5 spectacles fitted to your eyes" is displayed so as to instruct the entry of user to enter display information, such as athe screen resolution. Then, "How long is this line in centimeters on your monitor screen?" so as to instruct the entry of size of the display.

10 Next, a user information entry screen (Fig. 37) is transmitted to the user client 4001. On the user information entry screen, the user is instructed to enter user information and data as information identifying the user. The user information includes base attributes such as a user code, a
15 user identifier (ID), a user password, address, name, the date of birth, and telephone number, and data include the purpose of use, a near point distance, a far point distance, age, the previous lens power, vision of both eyes at the previous lens power, the balance of the right and left eyes at the previous
20 lens power, how many years the previous spectacles are used, the type of contact lenses (if also used), desired corrected vision, and a disease related to vision. After the entry of the personal information, a wearing condition entry screen (Fig. 38) is transmitted to the user client 4001. As wearing
25 conditions, the purpose of wearing spectacles or contact

lenses (the situations in which he/she wants to wear them, for example, to see the area around his/her hands, to see objects in the distance and to drive a car and the like) or a visual environment (at which distance and in which area he/she often
5 see objects in daily life, if she/he has much work on a personal computer as business activity, and ~~the like~~other environmental information).

Next, an uncorrected vision test screen is transmitted to the user client 4001.

10 An uncorrected vision test is executed in the order of astigmatism axis measurement, a far point vision test, and a near point vision test. Although a measurement method of estimating a far point distance by the measurement at a certain distance (at a distance equal to a length of a human
15 arm) is used in this preferred embodiment, a method of directly measuring a far point distance may also be used.

The astigmatism axis measurement is performed in the following procedure.

An astigmatism axis measurement step 1: First, a guidance
20 screen is transmitted (Fig. 39) to display "Follow the following instructions. The right eye is measured. First, four zones hatched with parallel lines are displayed. Move about 1 m away from the screen and then come up to the position where you can clearly see the lines of any one of the
25 four zones. Remove the spectacles or the contact lenses at

this step. When watching a displayed target, cover your left eye with a hand so as not to touch the eye."

An astigmatism axis measurement step 2: Next, an astigmatism axis measurement screen is transmitted so as to display an
5 astigmatism axis determination chart ~~composed of~~ including four patterns on the screen (Fig. 40).

An astigmatism axis measurement step 3: At this step, the user moves away about 1 m while covering the left eye with the left hand. At this time, the left eye is kept open. A state of the
10 user at this step is shown in Fig. 41.

An astigmatism axis measurement step 4: Next, the user brings his/her face gradually closer to the screen and stops at a distance allowing the distinction of four patterns. He/she should be careful not to be too close. A state of the user at
15 this step is shown in Fig. 42.

An astigmatism axis measurement step 5: At this step, it is determined whether the four patterns in the drawing appear the same to the user or any one of them appears darker or brighter.

An astigmatism axis measurement step 5-1: If "One of them
20 appears dissimilar," the corresponding pattern is clicked.

An astigmatism axis measurement step 5-2: If "All zones viewed equally well" or "Indistinguishable," the comment below the patterns is clicked.

An astigmatism axis measurement step 6: Subsequently, the
25 right eye is covered with the right hand so as to execute the

same process for the left eye.

An astigmatism axis determination chart ~~is composed~~
of includes linear groups in four directions, at 45 degrees, 90
degrees, 135 degrees, and 180 degrees, each ~~being formed~~
5 ~~by having~~ a plurality of parallel lines as shown in Fig. 40. If
the subject is astigmatic, he/she has a clear view in a
certain direction but the zone appears as if it were
compressed and paled in another direction. Therefore, he/she
is instructed to click the zone which appears dissimilar. The
10 reason ~~why that~~ the direction in which a view is different is
selected is because the direction giving a clear view for an
astigmatic may possibly be reversed at 90 degrees, depending
on a distance to the object. Therefore, there is a possibility
that the axis of astigmatism is erroneously determined if the
15 direction giving a clear view is determined first. Accordingly,
in preferred embodiments of the present invention, the
principal axis of astigmatism is not determined yet at this
step. At a later step of obtaining a far point distance, two
far point distances calculated by targets in two directions
20 are compared with each other ~~as~~ such that the direction with a
longer distance is determined as the principal axis.

Since the subject who is not astigmatic should
principally ~~has~~ have a uniform view in all the directions, the
subject who clicks "All zones viewed equally well" or
25 "Indistinguishable" is regarded as non-astigmatic so that the

following measurement is performed only for horizontal and vertical principal axes.

In the case where a resolution of the determination of axis of astigmatism is desired to be enhanced, linear groups
5 in four directions at intermediate angles between the respective four directions, that is, at 22.5 degrees, 67.5 degrees, 112.5 degrees, and 157.5 degrees may be added and displayed for selection.

Next, a far point distance is measured. Primarily, the
10 far point distance measurement examines how ~~long~~far away from the screen the subject can ~~position away from a screen, be~~located while watching the screen in a comfortable manner. He/she stops ~~the face~~ at the farthest ~~position~~location at which he/she can see without blur (the position at which the
15 screen starts ~~being blurred~~to blur). A distance measured from the screen to the eye corresponds to a far point distance. However, since there is a limit in moving away from the personal computer, the far point distance is calculated by measuring a far point vision at a certain distance ~~in this~~
20 ease.

The far point vision is measured by determining the limit of size of an object that the user can see at a certain distance. The far point vision in this preferred embodiment does not mean a generally used power unit such as 1.5 but
25 another numerical unit. Hereinafter, the far point vision will

be described in detail. The subject ~~perfectly stretches~~
~~out~~fully extends his/her arms while touching a display with
fingers. He/she ~~perfectly stretches out~~extends the arms with
~~the ramrod a~~ straight posture. In this state, targets for
5 measuring the far point vision are displayed on the display as
shown in Fig. 43. The subject selects the smallest one of the
displayed targets, of which three black ~~three~~ lines he/she can
clearly see. The number assigned to the target selected by the
subject is determined as the far point vision. The far point
10 distance is calculated from the far point vision based on the
size of the target and the distance from the screen.

The far point vision is measured in the following
procedure.

A far point distance measurement step 1: A far point distance
15 measurement screen is transmitted ~~so that a screen on which~~
far point distance measurement targets, each being different
in size with three vertical lines, are displayed in a set ~~is~~
~~displayed~~ (Fig. 43).

A far point distance measurement step 2: At this step, the
20 user touches the edge of the personal computer screen with the
middle finger while ~~perfectly stretching out~~fully extending
the right arm to the fingertips. A state of the user at this
step is shown in Fig. 44.

A far point distance measurement step 3: Next, the user covers
25 the left eye with the left hand so as to see the far point

distance measurement targets with the right eye. A state of the user at this step is shown in Fig. 45.

A far point distance measurement step 4: Next, the user ~~sees~~views a far point distance measurement chart displayed on the screen with ~~the ramrod a~~ a straight posture ~~in this state~~. A state of the user at this step is shown in Fig. 46.

A far point distance measurement step 5: At this step, it is determined whether the user can recognize three lines in the image or not. A state of the user at this step is shown in Fig. 47.

A far point distance measurement step 5-1: If the user cannot recognize three lines in any one of them, he/she clicks "YES." If the user recognizes three lines (even in the case where they are "blurred"), he/she clicks "NO." The criterion of recognition of the three lines is, for example, ~~as~~ shown in Fig. 48.

A far point distance measurement step 5-2: At this step, if the user answers "NO," the far point measurement targets are displayed in ~~the smaller order of size~~ of size so as to repeat a check until the image of which three lines are recognized appears.

A far point distance measurement step 6: Subsequently, the chart on the screen is changed to display far point distance measurement targets, each with three horizontal lines, so as to ~~direct the~~ perform a measurement (not shown).

A far point distance measurement step 7: Similarly, the user

sees the far point distance measurement targets with the right eye while covering the left eye with the left hand so as to carry out the same check. A state of the user at this step is shown in Fig. 49.

5 The check for the right eye is completed at this step. A far point distance measurement step 8: Next, the left eye will be checked. As for the right eye, the user touches the edge of the personal computer screen with the middle finger while ~~perfectly stretching out~~ fully extending the left arm to
10 the fingertips. He/she covers the right eye with the right hand to see the far point distance measurement targets with the left eye so as to carry out a check for the left eye in the same manner as for the right eye.

 Although the far point distance is measured with the
15 targets, each ~~with~~ having three vertical lines, ~~and the targets,~~
~~each with three horizontal lines,~~ in the above description, the measurement is performed in the direction selected by the above-described astigmatism axis measurement and the direction perpendicularly crossing it. If the user is oblique astigmatic,
20 the far point distance should be measured in two directions at 45 degrees and 135 degrees.

 Although the screen, on which the targets of all sizes are combined, is first displayed ~~as~~ such that the targets are then displayed in ~~the smaller order~~ of size in the above
25 description, the present invention is not limited thereto. The

targets may be individually displayed from the beginning. On the screen on which a plurality of targets are combined, the smallest target whose three lines can be recognized may be selected and clicked.

5 Next, a near point distance is measured. The near point distance measurement examines how close the subject can get to the screen while ~~watching~~viewing the screen in a comfortable manner. He/she stops the face at the nearest position at which he/she can see without blur. A distance measured between the
10 screen and the eyes corresponds to a near point distance.

The near point distance is measured in the following procedure.

The user folds a sheet of newspaper or copy paper in an elongated form (at a width of about 3 to 5 cm) and puts it
15 beside the personal computer (Fig. 50).

A near point distance measurement step 1: A near point distance measurement screen is transmitted so as to display a near point distance measurement target with three vertical lines on the screen (Fig. 51).

20 A near point distance measurement step 2: At this step, the user ~~brings~~moves his/her face as close to the screen as ~~much~~
~~as~~-possible while covering the left eye with the left hand (Fig. 52(A)). At this time, he/she verifies that the target is blurred. Fig. 52(B) shows a state where the near point
25 distance measurement target is viewed as blurred.

A near point distance measurement step 3: Next, the user ~~positions~~moves his/her face away ~~to the position where~~from the screen until he/she can recognize the three lines displayed on the screen (Fig. 53(A)). He/she should be careful that they

5 may be recognized at the position extremely close to the screen in some cases. A state where the near point distance measurement target is clearly seen is shown in Fig. 53(B).

A near point distance measurement step 4: Next, he/she stops ~~the face at the position allowing the recognition.~~closest

10 location at which he/she can recognize the target. Then, he/she rests his/her elbows on the desk and puts the folded paper on the temple. He/she ~~picks~~marks the paper with the fingers ~~in~~at the eye corner area. A state of the user at this step is shown in Fig. 54.

15 A near point distance measurement step 5: Next, he/she puts the top of the folded paper perpendicularly to the screen without moving ~~the~~his/her face. A state of the user at this step is shown in Fig. 55.

A near point distance measurement step 6: Next, the paper is
20 marked with the index finger of the left hand for the position of the right eye corner. After marking, the face may be moved. A state at this step is shown in Fig. 56.

A near point distance measurement step 7: At this step, the user presses a button "measure" on the upper left of the
25 screen (Fig. 57).

A near point distance measurement step 8: The end of the paper is aligned with the position 0 of the "measure" appearing on the screen so as to measure a distance to the mark (Fig. 58). Three "measures" are displayed on the screen. If one measure
5 is not sufficient, the paper is marked for the end of the measure and the remaining part is measured with the second one. If even two measures are not sufficient, the same operation is repeated for the third one.

A near point distance measurement step 9: Once "Next" button
10 is clicked, a near point distance measurement target with three horizontal lines is displayed on the screen (Fig. 59).

A near point distance measurement step 10: The same check is carried out while the left eye is being covered with the left hand (Fig. 60).

15 A near point distance measurement step 11: When the length is measured, the check for the right eye is completed. Next, the left eye is checked in the same manner while the right eye is being covered with the right hand (not shown).

For the above-described near point distance measurement
20 target, thin lines are used independently of vision of the subject.

Although the near point distance is measured for the target with three vertical lines and the target with three horizontal lines in the above description, the measurement is
25 performed in the direction selected by the above-described

astigmatism axis measurement and the direction perpendicularly crossing it. If the user is oblique astigmatic, the near point distance is measured in two directions at 45 degrees and 135 degrees.

5 The basic data measurement necessary for deciding a lens power is completed by the above operation. An eyeball optical model is constructed based on the basic data. In an eyeball optical model, an optical function of an eyeball within the range of accommodation of the user is detected so as to select
10 a lens power. The selection of a lens power based on the eyeball optical model will be described in detail in a lens power deciding system described below.

 A second preferred embodiment ~~constituting~~ of the lens power deciding step will be described by using an optometry
15 system as shown in Fig. 61. As illustrated, in this optometry system, a computer 6001 used by the subject and an optometry server 6010 providing an optometry method of the present invention are also connected to each other through the Internet 6002.

20 The optometry server 6010 is for providing an optometry service to the subject computer 1, and includes a WWW server 6020, a display screen database 6030, user interface ~~means~~ unit 6040, a subject database 6050, far point distance calculation ~~means~~ unit 6060, and lens power calculation ~~means~~ unit 6070.

25 The WWW server 6020 accepts ~~an~~ access from the subject

computer 6001 so as to provide an optometry function in accordance with an optometry procedure of the present invention. An HTTP server is used ~~as~~such that the subject computer 6001 can be ~~served~~accessed by a general-purpose Web browser.

The display screen database 6030 stores screen data that the WWW server 6020 presents to the accessed subject computer in accordance with the optometry procedure of the present invention. In this case, the first guidance screen, a subject's attribute entry screen, an astigmatism axis determination screen, a far point vision test screen, and a near point vision test screen, ~~and the like~~ are stored in an HTML format.

The user interface ~~means~~unit 6040 stores the attributes of the subject in the optometry information database 6050, activates the far point distance calculation ~~means~~unit 6060 to calculate a far point distance or activates the lens power calculation ~~means~~unit 6070 to calculate a lens power based on the information entered by the subject on the screen displayed by the WWW server 6020 on the subject computer 6001.

The user interface ~~means~~unit 6040 is a ~~process~~ activated from the WWW server 6020 by a CGI, whereas the far point distance calculation ~~means~~unit 6060 and the lens power calculation ~~means~~unit 6070 are ~~processes~~ activated from the user interface ~~means~~unit 6020. The optometry information

database 6050 stores subject attribute data entered by the subject, selected direction data of the astigmatism axis determination chart (right and left eyes), visibility limit data based on the vision test chart (right and left eyes × two directions), near point distance data based on the near point distance measurement chart (right and left eyes × two directions), calculated far point distances (right and left eyes × two directions), and calculated lens powers (right and left eyes) ~~and the like~~.

10 Next, an example of a procedure of eye examination by such an optometry system will be described with reference to Fig. 62.

First, the procedure displays a subject attribute input screen for acquiring the attributes of a subject (S10), and
15 then acquires the attributes entered by the subject ~~to~~ store and stores them as the subject data (S12). The attributes of the subject include the personal information such as the age, the gender, and the height, and wearing condition information regarding the situation where the spectacles or
20 the contact lenses are mainly used. Fig. 63 is an example of a display screen for acquiring personal information, and Fig. 64 is an example of a display screen for acquiring wearing conditions. Here, it is assumed that the "reading" in the wearing conditions is for near distances, the "—deskwork" and
25 "personal computer" for intermediate distances, and the

"driving cars" for far distances.

Then, the procedure displays an astigmatic axis measurement chart for determining the astigmatic axis (S14) to acquire the orientation that the subject has selected and store it as selected orientation data (S16). Fig. 65 is an explanatory view illustrating an example of a screen for use with the astigmatic axis measurement, Fig. 66 showing an example of the astigmatic axis measurement screen.

As illustrated, the astigmatic axis measurement chart is made up of four groups of a plurality of parallel lines, each group having lines extended in one orientation at an angle of 45 degrees, 90 degrees, 135 degrees, and 180 degrees, respectively. A subject with astigmatism ~~experiences~~ views the orientation which provides ~~the a sharper viewing view~~ and the orientations which provide ~~the a less-sharper blurry viewing~~, and is instructed to click on the zone in the orientation that provides a different viewing. The procedure instructs the subject to select the orientation that provides a different viewing as mentioned above. This is because astigmatism may possibly cause a 90 degree-inverted orientation to provide the sharper viewing depending on the distance to the object, and thus ~~employing~~ using the orientation that provides the sharper viewing at the first ~~gaze~~ viewing would possibly cause an error in measurement of the astigmatic axis. Therefore, the present invention is designed not to determine the main axis of the

astigmatic axis at this stage but to determine the orientation that is longer in distance as the main axis by comparing the two far point distances calculated using the targets in two orientations at the later stage where a far point distance is
5 calculated.

In principle, a subject without astigmatism is probably provided with the same viewing in all the orientations. Thus, the subject who clicks on "All are viewed in the same way" or "Indistinguishable" is considered to have no astigmatism and
10 undergoes the following measurements only on the horizontal and vertical main axes.

The astigmatic axis measurement chart has ~~the a green~~ background ~~in green and the black~~ lines ~~in black~~, with the width of the lines ~~having~~being two pixels and the width
15 between the lines ~~having~~being three pixels. A background color of white causes a miosis and a greater depth of field in the eyes due to its excessive brightness, thus ~~raising~~causing a problem of providing reduced difference in the ~~way~~viewing of
~~viewing~~ the four zones. This is why the eye-friendly green
20 base color is used to reduce brightness. ~~A color of black~~Black was ~~employed~~used as the color of the lines because a number of subjects who underwent an eye examination experiment determined consequently that black could be easily viewed. The width of the lines ~~has~~is at least two pixels because
25 particularly in the case of a CRT display, one pixel may

provide a different viewing between the horizontal/vertical and the diagonal direction due to the occurrence of focus blurring caused by the electron gun. The width between the lines was ~~so~~ set such that the spacing between the lines could
5 be recognized from a distance of 1m because an extremely short distance to the chart in the astigmatism measurement would invert the astigmatic axis by 90 degrees, possibly resulting in an error in the measurement. A vision of 1.0 (an angle of view of 0.1 degrees) indicates the capability of
10 distinguishing a slit of 0.29mm at a distance of 1m, which generally corresponds to one pixel on a 14-inch liquid crystal display or a 17-inch CRT. Therefore, two pixels correspond to a vision of about 0.5. However, since those who take the eye test need spectacles, the spacing was further expanded to ~~have~~
15 three pixels.

On the other hand, the four orientations were provided for the astigmatic axis because of the following reasons. That is, this makes it possible to select sufficiently practical spectacles or contact lenses even using the four orientations,
20 and the determination needs to be made as easily as possible without any error because the subject makes the determination by himself or herself.

Then, to measure the far point vision in the selected orientation that has been selected by the subject, the
25 procedure displays the vision measurement chart for the

selected orientation (S18) to acquire the viewing limit
selected by the subject, which is then stored as first viewing
limit data (S20). Fig. 67 is an explanatory view illustrating
an example of a screen for a far point vision measurement, Fig.
5 68 showing an example of the far point vision measurement
screen.

As illustrated, the vision measurement chart is a light
and dark line image made up of three black lines and two white
lines of a certain line width, a plurality of the charts being
10 displayed in each of which the width of the lines are varied
in I steps (from about 10 steps to 20 steps) corresponding to
vision. On the vision measurement charts, the subject is
instructed to click on the smallest mark that the subject can
distinguish the three lines. Since the subject is
15 ~~allowed~~permitted to select the mark that provides the viewing
of three lines as described above, the subject can make a
determination more easily ~~whenas~~whenas compared ~~with-to~~with-to the Landoldt
ring that is viewed to visually distinguish a single gap.

The subject is instructed to measure the far point vision
20 at a reach from the computer screen. This is because the
length of the arm is proportional in length to the height, and
thus the distance between the subject and the chart can be
predicted in accordance with the data on the height entered in
advance.

25 As described above, the measurement can be conveniently

carried out because the subject does not need to measure the distance to the computer screen or adjust the screen display size.

Likewise, to measure the far point vision in the
5 orientation perpendicular to the ~~selected~~-orientation selected by the subject, the procedure displays the vision measurement chart in the orientation perpendicular to the selected orientation (S22), and the viewing limit selected by the subject is acquired and stored as second viewing limit data
10 (S24).

Then, to measure the near point distance in the orientation selected by the subject, the procedure displays a near point distance measurement chart in the selected orientation (S26) to store the near point distance entered by
15 the subject as the first near point distance data (S28). Fig. 69 is an explanatory view illustrating an example of a screen for a near point distance measurement, Fig. 70 ~~showing~~shows an example of the near point measurement screen.

As illustrated, the near point distance measurement chart
20 has three black lines provided ~~in~~on a green background. The message on the screen instructs first the subject to move as close to the screen as possible and then move away therefrom to a position at which the subject can clearly see the three lines and measures the distance between the eyes and the
25 screen, thereafter instructing the subject to input the

distance in centimeters.

The near point distance measurement chart ~~employs~~uses thinner lines as compared ~~with~~to the aforementioned vision measurement chart regardless of vision of a subject, because
5 the chart is viewed in close proximity to the computer screen. However, because of the difference in resolution due to ~~the~~ age, thin lines are used for ~~the~~ youthyouths and slightly bolder lines are used for ~~the~~ middle--aged and ~~the~~ elderly people.

10 To measure the near point distance in the orientation perpendicular to the selected orientation selected by the subject, the procedure displays a near point distance measurement chart in the selected orientation (S30) to store the near point distance entered by the subject as the second
15 near point distance data (S32).

Then, the procedure determines the far point distance from the first viewing limit data, the first near point distance data, and the subject limit data to store the resulting distance as the first far point distance data (S34).
20 Likewise, the procedure determines the far point distance from the second viewing limit data, the second near point distance data, and the subject limit data to store the resulting distance as the second far point distance data (S36).

The far point distance is ~~operated~~measured using a
25 neural network ~~that~~which a number of subjects have taught in

advance. Fig. 71 is a view illustrating an exemplary configuration of a neural network for operating the far point distance. As illustrated, the input layer has I steps of far point vision (the viewing limit selected by the subject on the vision measurement chart), J steps of near point distance (the near point distance measured by the subject on the near point distance measurement chart), and K steps of subject attributes (the age, the gender, and the height), while the output layer has N steps of far point distance. The age and gender are employed as parameters because the accommodation ability of the eyes of the subject ~~is varied due to them~~ varies depending upon age and gender. The height, as described above, ~~that~~ which is proportional to the length of the arm, is used as a substitute parameter in order to adjust the distance between the subject and the screen to the length of the arm. As the method of learning, ~~employed is the so-called back-propagation method, but~~ is used. However, the method is not limited thereto.

Here, to make the conversion into the lens power easier, the near point distance of the input parameters and the far point distance resulted from the operation are each converted ~~for handling~~ to the value D (diopter) or the reciprocal of the distance measured in meters.

The neural network was designed to produce two independent learning models in the selected orientation of the

astigmatic axis and the orientation perpendicular to the selected orientation to perform calculations for each of them separately.

Since different types of displays provide different ways
5 of viewing the screens, the operation was performed using neural networks that had been separately taught depending upon the display being either ~~thea~~ liquid crystal display or ~~thea~~ CRT.

The astigmatic axis determination (S14) through the far
10 point distance calculation (S36) described above are performed for both eyes, right and left eyes, so as to calculate diopters (S: spherical diopter, C: ~~eylinderical~~cylindrical diopter and AX: axis of astigmatism) from the obtained selected direction data, the first far point distance data,
15 and the second far point distance data (S38).

Assuming that the first far point distance obtained at S34 is D1, its direction is AX1, the second far point distance obtained at S36 is D2 and its direction is AX2,
when $|D1| < |D2|$, $S = D1$, $C = D2 - D1$, $AX = AX1$, and
20 when $|D2| < |D1|$, $S = D2$, $C = D1 - D2$, $AX = AX2$.

Although the case where a diopter of the eye is merely calculated is described in the above-described preferred embodiment, a diopter of a lens may be determined from the obtained diopter of the eye and the wearing conditions in the
25 subject attribute data so as to accept an order of spectacles

or contact lenses.

In this case, based on the wearing condition in the subject attribute data, a distance for which the spectacles or contact lenses are normally used is determined from any one of
5 short-distance use (30 cm), intermediate-distance use (50 to 60 cm) and long-distance use (5 m) so as to determine a diopter of a recommended lens.

For example, for long-distance use, the far point distance D_1 is corrected to be 5 m (-0.2 D). Therefore, a
10 diopter of a recommended lens is $D_1 + 0.2$ D.

~~Eyeball~~An eyeball optical model generating ~~means~~unit for generating an eyeball optical model based on the lens power calculated by the lens power calculation ~~means~~unit and the attributes of the subject and a naked eye focal performance
15 confirmation ~~means~~unit for confirming focal performance of a naked eye by using the generated eyeball optical model may be provided so as to check the validity of the calculated lens power. As a result, a lens power can be determined with higher accuracy.

20 Moreover, a post-correction focal performance calculation ~~means~~unit for calculating focal performance after vision correction with a recommended lens by using the generated eyeball optical model may be provided so as to determine the recommended lens. As a result, a lens power more suitable ~~to~~
25 for the subject may be ~~presented~~provided.

Furthermore, a sharpness score calculation meansunit for calculating a sharpness score at a predetermined distance from a focal state with the recommended lens, an image sample generating ~~means~~unit for generating an image sample at the
5 calculated sharpness score, and an image sample display ~~means~~unit for displaying the generated image sample on the computer screen are provided ~~as~~such that the subject confirms the image sample with the recommended lens on. As a result, since the subject can check how well he/she can see with the
10 lenses on, a more suitable a lens power ~~can be decided~~is provided.

Although ~~it is described that~~ the far point distance calculation ~~means uses a~~ unit using a neural network that learns from a large number of subjects to obtain the far point
15 distance from the far point vision, the near point distance, and the attributes of the subject is described, the present invention is not limited thereto. The far point distance may be calculated by using a fuzzy inference so as to obtain a membership function or an inference rule from the data of a
20 large number of subjects. Moreover, from the data of a large number of subjects, the ~~relation~~relationship between the far point vision and the far point distance may be obtained as an approximate formula including the near point distance and the attributes of the subject as parameters so as to be used to
25 calculate the far point distance. In this manner, the

~~effects~~advantages of the present invention can be obtained.

Although the near point distance serves as an input parameter in the calculation of the far point distance in the above-described preferred embodiment, the present invention is
5 not limited thereto. The near point distance may be omitted. In this case, since the near point distance is ~~characteristic~~
~~in being~~ proportional to the age, the ~~effects~~advantages of the present invention can also be obtained.

Although it is described that the linear groups in four
10 directions, each ~~being formed by~~including a plurality of parallel lines, are displayed on one screen in the astigmatism axis determination chart ~~so~~such that the subject selects the zone that appears dissimilar in the above-described preferred embodiment, the present invention is not limited thereto. The
15 linear groups in four directions may be individually displayed in a sequential manner so as to select the direction in which the zone appears dissimilar.

Although a plurality of charts, each being different in size, are arranged and displayed on one screen in the vision
20 test chart ~~so~~such that the subject selects the limit of visibility in the above-described preferred embodiment, the present invention is not limited thereto. The charts in the respective sizes may be displayed in ~~the larger~~size order
~~so~~such that the limit of visibility is chosen by the subject.

25 Although the images of the selected direction in the

astigmatism axis determination and the direction
perpendicularly crossing it are displayed on the computer
screen for the display of the vision test chart and the near
point distance measurement chart in the above-described

5 preferred embodiment, the present invention is not limited
thereto. The images of four directions may be stored in the
display screen database 6030 in advance ~~so~~such that the image
is selected therefrom for display. Alternatively, image data
for a specific direction may be stored, whereas the images of
10 the other directions may be generated by rotating the image
with a graphic tool based on the direction data. Moreover,
graphic data of the image to be displayed may be stored ~~so~~such
that the images are drawn and generated by a drawing tool
based on the direction data. As described above, by using a
15 method of generating images by a graphic tool, a load on the
image display is increased. However, since an image in an
~~arbitrary~~arbitrary direction can be generated, a direction of
the axis of astigmatism may be ~~easily extended~~determined more
accurately.

20 Similarly, for the display of a plurality of charts with
varied line widths in the far point vision test, image data
with a specific line width may be enlarged and reduced by a
graphic tool or may be drawn and generated by a graphic tool.

Although it is described that the display size of the
25 astigmatism axis determination chart, the vision test chart,

and the near point measurement chart on the screen is not particularly changed by the computer settings in the above-described preferred embodiment, the present invention is not limited thereto. In order to obtain a lens power with higher accuracy, the screen settings of the computer may be acquired so as to change the display size of the screen based on them. The screen settings of the computer to be obtained are the type and the size of a display, the resolution settings of a computer, and ~~the like~~ other relevant parameters. They may be automatically obtained from property information of the computer or may be input as the subject attribute data.

As described above, images may also be enlarged or reduced by a graphic tool or may be drawn by a drawing tool in this case.

Furthermore, although it is described that an experimentally determined optimal color is used as a display color of the astigmatism axis determination chart, the vision test chart, or the near point distance measurement chart in the above-described preferred embodiment, the present invention is not limited thereto. A display color selecting function may be provided.

For example, color samples may be displayed in advance to the subject ~~so~~ such that the subject can select the color that he/she likes, or a predefined color may be automatically selected by screen ~~settings~~ settings of the computer ~~for~~ display.

Also for a display color of each of the charts, a plurality of display color patterns may be stored in advance ~~so~~such that a selection can be made therefrom. It is apparent that an image in a specific display color pattern may be
5 color-converted by a graphic tool or may be drawn by a drawing tool.

Similarly, although it is described that an experimentally defined optimal brightness is used for a brightness of a background or a segment of the astigmatism
10 axis determination chart, the vision test chart, and the near point measurement chart in the above-described preferred embodiment, the present invention is not limited thereto. A display brightness selecting function may be provided.

Also for a display brightness of each of the charts, a
15 plurality of display brightness patterns may be stored in advance ~~so~~such that a selection can be made therefrom. It is apparent that an image in a specific display brightness pattern may be brightness-converted by a graphic tool or may be drawn by a drawing tool.

20 Although it is described that the attribute data of the subject is acquired each time the subject receives an optometry service in the above-described preferred embodiment, the present invention is not limited thereto. It is apparent that the attribute data ~~is~~may be pre-stored as a customer
25 database ~~so~~such that necessary data is extracted from the

database. As described above, the customer database is provided so as to store a history of the optometry services provided ~~so~~thus far and data of sold spectacles and contact lenses in addition to the subject attribute data described above. As a result, more accurate optometry in accordance with the characteristics of the subject can be ~~carried out~~performed so as to ~~present~~provide more ~~proper~~accurate corrective lenses.

It is described that the eye examination is carried out ~~mainly~~primarily for short-sighted persons who are also

astigmatic in the above-described preferred embodiment.

However, since the near point distance is obtained in addition to the far point distance in this preferred embodiment, the eye examination may also be ~~carried out~~used for subjects who are ~~long~~farsighted or ~~presbyope~~based on itpresbyopic.

More specifically, if the far point distance is extremely long and the near point distance is also long-~~too~~, there is a possibility that he/she may be ~~long~~farsighted or ~~presbyope~~presbyopic. If the accommodation ability of eyes of the subject is obtained, the determination of ~~longsightedness~~farsightedness or presbyopia can be made based on it.

Therefore, for example, the age or gender of the subject is used as a substitute parameter for the accommodation ability of eyes. A neural network, which uses the far point distance, the near point distance, and the attributes of the

subject (age and gender) as inputs and outputs the diopter of astigmatism and the diopter of long-sightedness, is made to learn a large number of subjects who are ~~long-farsighted~~ or ~~presbyope-presbyopic~~. By using it, the diopter of ~~long-~~
5 farsightedness or presbyopia may also be calculated.

Moreover, the accommodation ability of eyes of the subject may be actively measured by using a computer screen so as to determine the diopter of ~~long-farsightedness~~ or presbyopia based on it. For this determination, for example, a
10 method of measuring the tracking ability of an image traveling on the computer screen, measuring the visibility when the subject moves changing a distance with the computer screen in a rapid cycle ~~or the like is~~ conceivable. In this manner, not only short-sighted persons who are also astigmatic but also
15 subjects who are ~~long-sighted or presbyope may be dealt with,~~ farsighted or presbyopic may use the system. Therefore, an optometry system for everybody ~~can be constructed~~ is obtained.

According to preferred embodiments of the present
20 invention, the attributes of the subject are obtained. In addition, the astigmatic axis determination chart is displayed on the computer screen so as to obtain the direction selected by the subject. The vision test chart is displayed for the obtained direction and the direction perpendicularly crossing
25 it so as to obtain the limit of visibility selected by the

subject. The far point distances are calculated from the obtained limit of visibility and the obtained attributes of the subject so as to calculate the lens power from the obtained direction and two calculated far point distances.

5 Therefore, the present invention is effective in that the subjects who are astigmatic can be dealt with and the eye examination can be ~~carried out~~performed in a simple manner by using the computer screen without requiring any special equipment.

10 Next, a third preferred embodiment of the lens power deciding step described above will be described by using a lens power deciding system shown in Fig. 72. The lens power deciding system is for constructing an optical model of an eyeball of the user to decide a power of a corrective lens,
15 and includes a central processing unit 8012. The central processing unit 8012 controls the operations of: a data input section 8014; an input data check section 8016; a far point distance calculating section 8018; a start eyeball optical model deciding section 8020; an eyeball optical model focal
20 performance calculating section 8022; a model validity examining section 8024; an eyeball optical dimensions-accommodation range determining section 8026; an eyeball optical model deciding section 8028; a viewed image generating section 8030; a sharpness score generating section 8032; and a
25 display section 8036. Hereinafter, the schema of each of the

sections controlled by a central control unit 12 will be described.

The data input section 8014 is for inputting the age of a person who wants to wear corrective lenses, such as spectacles or contact lenses, the conditions of use of the corrective lenses, the axis of astigmatism, the far point vision, and the near point distance. The data input section 8014 ~~is composed of~~includes equipment such as a keyboard, a mouse, or a touch panel to which a person directly inputs data or equipment configured to be able to receive data through a network by using a modem, or a LAN card, ~~or the like,~~ and a program for controlling the equipment.

The far point vision in this preferred embodiment does not mean a generally used power unit such as 1.5, but rather, another numerical unit. Hereinafter, the far point vision will be described in detail. On a display such as a computer, targets as shown in Fig. 73 are displayed. The subject ~~perfectly stretches out~~fully extends his/her arms while touching a display with fingers. He/she ~~perfectly stretches out~~fully extends the arms with the ~~ramed~~ straight posture. In this state, the targets for measuring ~~a~~ vision are sequentially displayed in the ~~larger~~ order of size on the display as shown in Figs. 73(a) to 73(c). The subject selects the smallest one of the displayed targets, of which black three lines can be clearly seen. The number assigned to the

target selected by the subject is determined as the far point vision. The far point distance ~~can be~~ is calculated from the far point vision.

The input data check section 8016 checks the consistency
5 of the input value from a value of the data input to the data input section 8014. The input data check section 8016 stores therein a large amount of stored standard sample data 8016a in which data of the axis of astigmatism, the far point distance, and the near point distance are associated with each other on
10 the basis of ~~the~~ age. The input data check section 8016 determines whether a value of the data input to the data input section 8014 is valid as a result of comparison with the standard sample data 16a.

The far point distance calculating section 8018
15 calculates the far point distance from the far point vision corresponding to the data input to the data input section 8014. The far point distance calculating section 8018 stores data related to age, gender, height, far point vision, and the near point distance. Based on the input data of age, gender, height,
20 far point vision, and near point distance, the far point distance calculating section 18 calculates the best far point distance that is the most suitable to the data.

The start eyeball optical model deciding section 8020
decides a start eyeball optical model based on the age of the
25 subject and the approximated lens power.

Now, the eyeball optical model will be explained below.

In the eyeball optical model, light-beam refractive elements of a human eye, as shown in Fig. 74, are configured as ~~an~~a mathematical/physical numerical model ~~as~~of a lens. As shown
5 in Fig. 74, the eyeball optical model ~~comprises~~includes light-ray refractive elements of the eyeball such as the cornea, the anterior chamber, the lens of the eye, ~~and~~ the vitreous body, and the retina. An eyeball optical model is constructed with respect to these light-beam refractive elements in accordance
10 with the following optical dimensions.

Cornea: the radius of curvature R_3 of the front surface, the thickness, the refractive index, and the radius of curvature R_4 of the rear surface

Anterior chamber: the thickness and the refractive index

15 Lens of the eye: the radius of curvature of anterior cortex (the radii of curvature R_5 , R_6 , R_7 , R_8 , R_9 , and R_{12}) and the thickness of the anterior cortex; the radius of curvature of nucleoplasm (the radii of curvature R_{13} , R_{14} , R_{15} , R_{16} , R_{17} , R_{18} , R_{19} , R_{20} , R_{21} , R_{22} , R_{23} , R_{24}) and the
20 thickness of the nucleoplasm; and the radius of curvature of posterior cortex (the radii of curvature R_{25} , R_{26} , R_{27} , R_{28} , R_{29} , R_{30} , R_{31} , R_{32} , and R_{33}) and the thickness of the posterior cortex and their respective refractive indices

Vitreous body: the refractive index and the thickness

25 Retina: Radius of curvature R_{34}

The aforementioned optical dimensions are different from each other depending on the age and the accommodation ability of the eye of each individual. However, in this preferred embodiment, an eyeball optical model is pre-constructed as a standard pattern with reference to values from living body measurement data on Japanese people. For example, regarding the anterior chamber,

Depth of anterior chamber: the depth of anterior chamber is 3.66mm for the ages of 8-15, 3.71mm for the ages of 16-30, 3.51mm for the ages of 31-51, 3.18mm for the ages of 51-77.

Length of the eye axis: the length of the eye axis shows a tendency contrary to the aging tendency of the depth of anterior chamber.

Lens of the eye: there is uneven distribution of refractive indices. The refractive index of the surface is irrelevant to age, but the refractive index of the nucleus of the lens of the eye increases a little by aging. The weight of thickness increased by aging is 174mg for the ages of 20-39, 204mg for the ages of 40-59, and 266mg for the ages of 80-99.

Although the eyeball optical model is constructed based on the aforementioned values in this preferred embodiment, the eyeball optical model may also be constructed based on the values listed in the literature data. The following is an example of literature data applicable to the construction of an eyeball optical model.

(i) Concerning the depth of the anterior chamber

According to "Study on the depth of anterior chamber" by Katsuo Aizawa, Japanese Ophthalmological Society Journal Vol. 62, No. 11 (1958), the relationship between the depth of the anterior chamber and the age varies as follows:

3.66mm for ages from 8 to 15,

3.71mm for ages from 16 to 30,

3.51mm for ages from 31 to 51, and

3.18mm for ages from 51 to 77.

That is, the study ~~tells~~indicates that the depth of the anterior chamber tends to gradually increase as the body grows from the youth and reach the maximum level when the body has grown up, and thereafter, gradually decrease as the body deteriorates.

(ii) Concerning the length of the eye axis

According to "Study No. 1 on the essence of shortsightedness" by Tsutomu Sato, et al, Japanese Ophthalmological Society Journal Vol. 63, No. 7 (1959), for the low degree of shortsightedness, the length of the eye axis gradually increases as the degree of myopia ~~becomes~~ higherincreases, showing a strong correlation therebetween.

(iii) Concerning the weight of the lens of the eye

According to "The eye" by Davson Hugh (1909-) and Graham L.T. Jr., New York; London Academic Press, the weight of the lens of the eye only increases with advancing age as follows:

174mg for ages from 20 to 39,

204mg for ages from 40 to 59, and

266mg for ages from 80 to 99.

(iv) Concerning the thickness and diameter of the lens of the

5 eye

According to Complete Collection of New Clinical
Ophthalmology 3A, by Hiroshi Ichikawa, et al, 1993, KANEHARA &
CO., LTD, the thickness and diameter of the lens of the eye
increases with advancing age.

10 The eyeball optical model that has been pre-constructed
by applying the aforementioned values is used as the start
eyeball optical model determined by the start eyeball optical
model deciding section 8020. The start eyeball optical model
is not constructed for the combinations of all ages and
15 approximate lens powers, but with attention being given to the
fact that the start eyeball optical model has ~~generally~~ common
eye characteristics for the same age and approximate lens
power, such an eyeball optical model is pre-constructed, ~~which~~
~~has~~ to have a median value in each age class represented on
20 the vertical axis and a median value in each approximate lens
power class represented on the horizontal axis. The vertical
axis representing M classes and the horizontal axis
representing N classes allow for constructing M by N start
eyeball optical models. That is, ~~employed is a table~~ is used
25 in which the vertical axis represents the age class (e.g., at

five year intervals up to twenty years of age, and at 10 year intervals for 20 years of age or more) and the horizontal axis represents the approximate lens power (e.g., at intervals of 1.0D). With this table, such a start eyeball optical model is
5 pre-constructed ~~at~~ for a combination of median values in each class (e.g., the 35 years of age and the lens power of the amount of correction required being -2.5D).

Although $M \times N$ eyeball optical models are constructed as start eyeball optical models. ~~Among them,~~ and the start
10 eyeball optical model deciding section 8020 uses the eyeball optical model having the closest value as a start eyeball optical model ~~although~~ among them in this preferred embodiment, it is not limited thereto. A start eyeball optical model may be constructed from the values of the constructed eyeball
15 optical models based on the most suitable value of a light-beam refractive element from the measured age and approximated lens power.

The start eyeball optical model ~~decided~~ determined in the start eyeball optical model deciding section 8020 is used as
20 an initial value in the eyeball optical model deciding section 8028 described below to perform an optical system design automation process for constructing an eyeball optical model ~~proper to~~ that is accurate for the person. In this start eyeball optical model, the design automation process is
25 terminated within a short time, and therefore, the processing

~~speed can be~~ time is reduced as compared with an optical system design automation process using an independent start eyeball optical model which is not based on the age or the approximated lens power. Moreover, the reliability of solutions (optical dimensions enabling the best focal state) is highimproved.

The eyeball optical model focal performance calculating section 8022 calculates focal performance of the eyeball optical model in a naked eye state of the subject or with corrective lenses. As a state of the eyeball for calculating a focal state, ~~there is a~~ state at the near point or the position within the range of accommodation ability in the vicinity of the near point, a state at the far point or the position within the range of accommodation ability in the vicinity of the far point, or a state at the position away from the near point and the far point is used.

The model validity examining section 8024 examines the validity of the eyeball optical model at the limit of accommodation on the near point side and/or on the far point side based on the focal performance calculated by the eyeball optical model focal performance calculating section 8022.

The eyeball optical dimensions-accommodation range determining section 8026 determines the range of accommodation of the eyeball at an accommodation midpoint from the input near point distance and the calculated far point distance.

Furthermore, the eyeball optical dimensions-accommodation range determining section 8026 is configured to generate an image of the eyeball optical model in which the range of accommodation of the eyeball at the accommodation midpoint is
5 determined.

The eyeball optical model deciding section 8028 adjusts the values of the optical dimensions of the start eyeball optical model ~~so~~such that the focal state in the eyeball of the subject at the midpoint of accommodation calculated from
10 the near point distance and the far point distance of the subject ~~becomes~~is optimal, thereby ~~deciding~~determining the eyeball optical model ~~fitted~~that corresponds to a state of the eye of each person.

The viewed image generating section 8030 generates visual
15 images viewed by the subject before and/or after the correction by ~~means~~unit of a corrective lens based on the result calculated in the eyeball optical model focal performance calculating section.

The sharpness score generating section 8032 derives the
20 sharpness score that indicates mathematically the degree of sharpness of viewing by the subject before and/or after the correction by ~~means~~unit of a corrective lens.

The sharpness score indicates how sharply an image is viewed in an arbitrary numerical value and is calculated, for
25 example, ~~so~~such that the higher numerical value indicates that

the image is more sharply seen.

The lens power selecting section 8034 examines optical performance when the subject wears spectacles or contact lenses to select a lens power.

5 The display section 8036 is a display device for confirming an ~~operation~~operating condition of a corrective lens deciding server 8010 or for confirming a value of the data input by the subject or the calculated data. As the display section 8036, a display connected to the computer or a
10 display of the computer connected to the corrective lens deciding server 8010 via the data input section 8014 is used.

Next, an operation of the present invention will be described with reference to Fig. 75.

(1) The gender, the age, the axis of astigmatism, the
15 near point distance, the far point vision, and the conditions of use of corrective lenses (for reading, deskwork, driving, and the like) of the subject are input by using the data input section 8014.

(2) The input data is examined by the input data check
20 section 8016.

(3) The far point distance is calculated from the far point vision by the far point distance calculating section 8018.

(4) By using a relational table of the range of
25 accommodation in terms of age, supposing an average range of

accommodation at an assumed age, eyeball
~~refractive~~refractive values at the upper limit and the lower
limit of the range of accommodation are derived. Based on them,
the near point distance and the far point distance are
5 corrected.

(5) A midpoint in the range of accommodation of the eyes
of the subject is obtained from the near point distance and
the far point distance. Furthermore, the approximated lens
power is calculated.

10 (6) A start eyeball optical model is ~~decided~~selected by
the start eyeball optical model deciding section 8020 from the
age and the value of the approximated lens power.

(7) The focal performance is calculated by the eyeball
optical model focal performance calculating section 8022 using
15 the ~~decided~~selected start eyeball optical model. The ultimate
eyeball optical model in an intermediate state of the
accommodating function of the eyes is ~~decided~~determined by the
eyeball optical model deciding section 8028. More specifically,
a light beam is ~~incident~~directed on the eyeball optical model
20 in the accommodation midpoint state by the eyeball optical
model focal performance calculating section 8022 so as to
calculate the focal performance of the light beam on a retina.
The optical system design automation process is performed to
achieve the best focal state. The optical dimensions are
25 changed by the eyeball optical model deciding section 8028 to

determine optimal solutions (optical dimensions). In the construction of the eyeball optical model at the accommodation midpoint, the automatic optical design calculation begins with the aforementioned start eyeball optical model to

5 automatically determine the optical dimensions of a human eyeball so as to provide the optimal focal performance.

As used herein, the automatic optical design calculation refers to the automatic process for determining optical dimensions by light beam tracking using an automatic lens
10 design program. As a typical example of these techniques, the dumped least squares method is available.

The calculation minimizes the sum of squares of the amount of deviation in position from the point of arrival of light on the retina while the values of the optical dimensions
15 of the eyeball optical model are ~~being~~ gradually varied (a radius of curvature and an intervals of surfaces are varied while a refractive index is unchanged; in the case of non-spherical surface, a radius of curvature of reference spherical surface and aspherical surface coefficient are
20 varied) to satisfy a final performance condition (in this preferred embodiment, a focal state in which the cases where a plurality of beams of light are impinged from an infinitesimal point object located in the accommodation midpoint condition upon the pupil diameter (e.g., $\phi = 3\text{mm}$) of the eyeball optical
25 model at various heights of incidence are calculated to track

the refraction change of beams of light, thereby allowed to focus onto a point on the retina). This is the same as in an "eyeball optical model construction process of a person at the midpoint of accommodation" described below.

5 (8) The model validity examining section 8024 is used to check the validity of the eyeball optical model at the accommodation limit (on the near point side). In this validity check, the eyeball refractive power is ~~brought-up~~increased (UP) by the amount of accommodation ability of a human eyeball,
10 and then the automatic optical design calculation is performed to confirm a good focal performance.

As used herein, the "~~bringing-up~~increasing (UP) the eyeball refractive power by the amount of accommodation ability" ~~means as follows. performs the following operations.~~

15 Assuming that the far point distance is 1m (-1.0D) and the near point distance is 25cm (-4.0D), the accommodation midpoint position is 40cm (-2.5D) and an UP in the eyeball refractive power corresponding to the amount of correction of -1.5D is required on the near point side with respect to the
20 accommodation midpoint position. As described above, an increase in eyeball refractive power corresponding to this -1.5D is provided as follows. While the boundary conditions for the automatic optical design are being controlled, a plurality of beams of light are ~~impinged~~directed from an infinitesimal
25 point object located at a near point distance of 25cm upon the

pupil diameter (e.g., $\phi = 3\text{mm}$) of the eyeball optical model at various heights of incidence to track the beams of light. Thus, the automatic optical design is performed while the optical dimensions are being varied so as to focus the beams of light on a point on the retina.

Suppose that this has conceivably resulted in the convergence of the light on one point. In this case, it is determined that the optical model has been successfully simulated at the accommodation limit, and the eyeball optical model of the subject is valid at the accommodation midpoint.

(9) The model validity examining section 8024 checks the validity of the eyeball optical model at the accommodation limit (on the far point side). In the validity check, the eyeball refractive power is ~~brought down~~decreased (DOWN) by the amount of accommodation ability of a human eyeball, and then the automatic optical design calculation is performed to confirm ~~a good~~ focal performance.

As used herein, the "~~bringing down~~decreasing (DOWN) the eyeball refractive power by the amount of accommodation ability" ~~means as follows.~~

~~—~~performs the following operations. Assuming that the far point distance is 1m (-1.0D) and the near point distance is 25cm (-4.0D), the accommodation midpoint position is 40cm (-2.5D) and a DOWN in the eyeball refractive power corresponding to the amount of correction of +1.5D is required on the far

point side with respect to the accommodation midpoint position.

As described above, a decrease in eyeball refractive power corresponding to this +1.5D is provided as follows. The boundary conditions for the automatic optical design ~~are being~~

5 controlled, a plurality of beams of light are ~~impinged~~directed from an infinitesimal point object located at a far point distance of 1m upon the pupil diameter (e.g., $\phi = 3\text{mm}$) of the eyeball optical model at various heights of incidence to track the beams of light. Thus, the automatic optical design is
10 performed while the optical dimensions are ~~being~~ varied so as to focus the beams of light on a point on the retina.

Suppose that this has ~~conceivably~~ resulted in the convergence of the light on one point. In this case, it is determined that the optical model has been successfully
15 simulated at the accommodation limit, and the eyeball optical model of the subject is valid at the accommodation midpoint.

(10) The model validity examining section 8024 checks the validity of the eyeball optical model outside the accommodation limits on the near and far point sides, i.e.,
20 outside the range of accommodation of the eyeball.

(11) The eyeball optical dimensions-accommodation range determining section 8026 finally determines the range of accommodation of the eyeball optical dimensions for the eyeball optical model at the accommodation midpoint position.

25 (12) An image of the decided eyeball optical model, for

example, a cross-sectional view of an eyeball as shown in Fig. 74 is generated by the eyeball optical dimensions- accommodation range determining section 8026. The description for the eyeball optical model may be displayed therewith.

5 (13) The focal performance with the accommodation at three distances in a naked eye state of the subject is calculated by the eyeball optical model focal performance calculating section 8022.

 The eyeball optical model at the accommodation midpoint
10 position and the range of accommodation of the optical dimensions are determined as follows.

 The model validity examining section 8024 performs the-
processing for checking the validity of the eyeball optical
model at the accommodation limit (on the near point side) and
15 ~~the model validity examining section 8024 performs the-~~
~~processing for checking the validity of the eyeball optical-~~
~~model at the accommodation limit (on the far point side).~~

 These checks determine, as a result of the processing for
constructing an eyeball optical model of the person at the
20 accommodation midpoint, that the eyeball optical model is
valid at the accommodation midpoint position. The eyeball
optical model is then used in the focal performance
calculation processing, discussed later, which is accompanied
by accommodation at the three distances with the eye
25 uncorrected, and the focal performance calculation processing

which is accompanied by accommodation at the three distances with the eye corrected. "The three distances" ~~is~~ are chosen such that the viewed image is ~~possibly~~ substantially changed-~~remarkably~~, e.g. 0.3m (for reading), 0.5m - 0.6m (for
5 deskwork), and 5m (for car driving). ~~It can be said that the~~
The range of changes in optical dimensions at the accommodation limits (in particular, the range of changes in thickness of the lens of the eye within which the lens of the eye is made thinner or thicker, in the radius of curvature of
10 the front surface, and in the radius of curvature of the rear surface) has also been determined by the model validity examining section 8024 performing the processing for checking the validity of the eyeball optical model at the accommodation limit ~~(on the near point side) and the model validity~~
15 ~~examining section 8024 performing the processing for checking the validity.~~ The determination of the range of the eyeball optical model at the accommodation limit (on the far point side). ~~The determination of them makes it possible to simulate the changes enables simulation of the~~ accommodation of the eye
20 according to the distance to an object. The amount of an increase (UP) or a decrease (DOWN) in eyeball refractive power from the accommodation midpoint position is determined according to the distance to an object to perform the automatic optical design while the boundary conditions are
25 ~~being~~ controlled, like similar to the processing of the model

validity examining section 8024 for checking the validity of eyeball optical model at the accommodation limit (on the far distance side).

The optical dimensions determined as described above
5 represent the condition of the eye in which the eyeball -
virtually performs focus accommodation.

The calculation is repeated until no more improvement ~~can~~
~~be~~-is made in focal performance, and the resulting optical
dimensions are determined as the best focal performance at the
10 distance to the object.

To evaluate the focal performance, several hundreds of
beams of light equally dispersed are ~~impinged~~directed from an
infinitesimal point object located at a certain distance upon
the pupil diameter (e.g., $\phi=3\text{mm}$) of the eyeball optical model
15 to track the beams of light, thereby calculating where the
beams of light are focused on the retina. To evaluate the
degree of blurring, ~~the~~-a two-dimensional Fourier transform is
performed on the intensity distribution of a point image on
the retina, thereby calculating the spatial frequency
20 characteristics (OTF) to evaluate the image.

(14) The focal performance with the accommodation at
three distances described above for the optical model after
vision correction with corrective lenses is calculated and
examined by the eyeball optical model focal performance
25 calculating section 8022.

That is, an actual spectacle lens (with known radii of curvature of the front and rear surfaces of the lens and a known refractive index of the glass material) is placed in front of the eyeball optical model to perform a calculation
5 ~~like~~similar to the focal performance calculation processing with the eye uncorrected.

From the approximate lens power and the wearing conditions, an appropriate virtual lens is determined to perform an optical simulation on the focal performance with
10 the spectacle/contact lens being worn.

On the other hand, when the balance between the sharpness scores at the three distances ~~is badly kept~~unsatisfactory, the lens power is slightly varied to perform the optical simulation again.

15 (15) The sharpness score generating section 8032 is used to vary the optical dimensions of the eye within the range of accommodation ability to create the condition in which the focal performance is optimally provided, calculating the sharpness score at that time. The relationship between the
20 sharpness score and the viewed image is illustrated in Fig. 76. The sharpness score is calculated based on the ~~result~~results of focal condition calculated by the eyeball optical model focal performance calculating section 8022.

Several hundreds ~~of~~ beams of light equally dispersed are
25 ~~impinged~~directed from an infinitesimal point object located at

a certain distance upon the pupil diameter (e.g., $\phi = 3\text{mm}$) of the eyeball optical model to track the beams of light, thereby calculating where the beams of light are focused on the retina.

A value obtained by ~~the~~ a two-dimensional Fourier transform

5 being performed on the intensity distribution of the point image is called the spatial frequency characteristics (OTF).

Checking how the intensity is distributed on the retina ~~makes~~

~~it possible to evaluate~~ enables evaluation of the degree of

blurring. The spatial frequency is a value which represents

10 the fineness of a stripe pattern and is defined as the number of stripes per unit length.

For a visual system, ~~it~~ the spatial frequency is

represented by the number of stripes per visual angle of 1

degree. For example, assuming that the spacing of the stripes

15 is w (degrees), ~~it~~ the spatial frequency is given that $u = 1/w$ (cycles/deg).

The value of w used for ~~the evaluation of~~ evaluating

blurring is ~~found~~ determined from the resolution of the retina,

~~allowing~~ which enables the sharpness score to be calculated

20 based on the value of u provided at that time.

(16) The viewed image generating section 8030 is then

used to generate and display visual images at the three

distances before and after the correction with the recommended

lens (Fig. 77). By this processing, the user can confirm on

25 the screen the ~~ways of~~ viewing quality with the uncorrected

eye and with the recommended lens being worn.

The viewed image generating section 8030 is used to prepare images at the three distances which are photographed at high resolution. Generation of the view images is performed
5 such that ~~the~~ N by N size smoothing filter processing is performed on these images pixel by pixel to blur the images ~~to blur the images~~. The degree of blurring ~~can be~~ is adjusted by the value of N (at a minimum of 3), filter weighting, and the number of processing ~~times of the processing~~. The spatial
10 frequency analysis is performed on the images that have been filtered in order to determine the degree of blurring, which is in turn associated with the sharpness score that has been determined through the calculation of the sharpness score.

Several images are prepared which correspond to ~~some~~ the
15 sharpness scores. Furthermore, the score values are calculated ~~which and~~ correspond to the images obtained by the special smoothing filter processing being performed once on the prepared images.

The score value determined by the calculation of the
20 sharpness score is used to directly ~~call~~ display the corresponding image ~~for display or to filter the image to display the resulting~~ displayed image corresponding to its sharpness score.

(17) Furthermore, images showing the respective views at
25 three distances are presented for comparison by the viewed

image generating section 8030 while replacing lens. More specifically, a lens power is changed to perform an optical simulation with spectacles or contact lenses on. Then, the optical dimensions are changed within the range of

5 accommodation of the eyeball to ~~create a state where~~optimize the focal performance ~~is optimal~~. A sharpness score ~~at that time is~~is then calculated.

If a sharpness score at a specific lens power has already been calculated by the lens power selecting section 8034, ~~it~~
10 the sharpness score may be ~~configured to use~~ obtained using the data.

(18) The subject visually determines a corrective lens at a corrective power that he/she desires from the displayed viewed image and a sharpness score so, such that the number,
15 and code of the ~~like indicating the~~desired corrective lens to be used is selected by the data input section 8014.

As described above, this lens power deciding system includes: the input ~~means~~unit for inputting information related to a state of the eyes of the user, the eyeball
20 optical model deciding ~~means~~unit for deciding an eyeball optical model in accordance with the information related to the input state of the eyes, the eyeball accommodation range determination ~~means~~unit for examining optical performance of the eyeball within the range of accommodation of the user in
25 the decided eyeball optical model to determine the range of

accommodation of the eyeball⁺, and the lens power selecting
~~means~~unit for examining the optical performance when the user
wears spectacles or contact lenses to select a lens power.
Therefore, a lens power of spectacles or contact lenses fitted
5 to eyes of each person ~~can be decided~~is determined.

In the above description, the spectacle and contact lens
selecting system, the spectacle virtual try-on system, and the
remote subjective vision test system are described as
independent spectacle order/sales centers, respectively. In
10 practice, however, they are integrated on a single computer or
server to share the database, or they are integrated by
performing a distributed processing with a plurality of
computers or servers ~~so~~such that the user information, the
frame selection information, the vision test information, and
15 ~~the like~~other relevant information are intercommunicated
through a LAN and ~~the like~~other suitable network. As a result,
the user accesses from a single user client to a single site
to receive a series of order/sales services of spectacles or
contact lenses.

20 The lens power may be ~~decided~~determined by using a lens
power obtained by the lens power deciding system or by using a
lens power obtained by the optometry system.

Moreover, ~~owing~~due to the spectacle and contact lens
selecting system obtained by the integration of the lens power
25 deciding function by the remote subjective vision test system,

the lens power deciding system or the optometry system as described above and the frame selecting function by the above-described spectacle virtual try-on system, lenses fitted to eyes of each person can be remotely selected. In addition, a
5 ~~frame or the like~~frames can be selected after visual confirmation of a wearing state of each person. Therefore, the user is assured to receive the order/sales services of spectacles or contact lenses through a network such as the Internet.

10 Although the user client, the spectacle order/sales center, and the external payment transaction agency are connected by the Internet in the above-described preferred embodiment, the present invention is not limited thereto. ~~It is apparent that they are~~Alternatively, the spectacle
15 order/sales center and the external payment transaction agency may be partially or entirely connected through a LAN, or a WAN ~~or the like~~ within a specific organization. Moreover, the present invention is not necessarily limited to the case where the optometry service is provided for the subject through the
20 network. The spectacle and contact lens selecting system according to the present invention may be installed in a store ~~or the like~~ to provide the order/sales service of spectacles in a stand-alone fashion.

Although the spectacle and contact lens selecting system
25 is described in the above-~~embodiment~~-described preferred

embodiments, according to the spectacle and contact lens selecting method including the respective ~~means~~unit in the spectacle and contact lens selecting system of the present invention as steps, the effects of the present invention can
5 be obtained independently of a hardware ~~structure~~configuration.

Since the method of the present invention can be ~~realized~~achieved by a general-purpose personal computer, a computer program describing the method of the present invention in an executable manner in the personal computer may
10 be provided for the user so as to provide a selection service of spectacles or contact lenses. It is apparent that the computer program may be provided by a recording medium such as a CD-ROM or may be provided for the user by downloading it through the Internet or ~~the like~~other suitable network.

15 As described above, according to the present invention, easy selection of spectacles and contact lenses fitted to eyes of each person ~~can be~~is ensured.

While the present invention has been described with
20 respect to preferred embodiments, it will be apparent to those
skilled in the art that the disclosed invention may be modified
in numerous ways and may assume many embodiments other than
those specifically set out and described above. Accordingly, it
is intended by the appended claims to cover all modifications
25 of the invention which fall within the true spirit and scope of

the invention.